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THE NAVAL ARCHITECT

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MAY 2021

HRH THE PRINCE PHILIP, DUKE OF EDINBURGH 1921-2021

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TRIBUTE

HRH THE PRINCE PHILIP, DUKE OF EDINBURGH

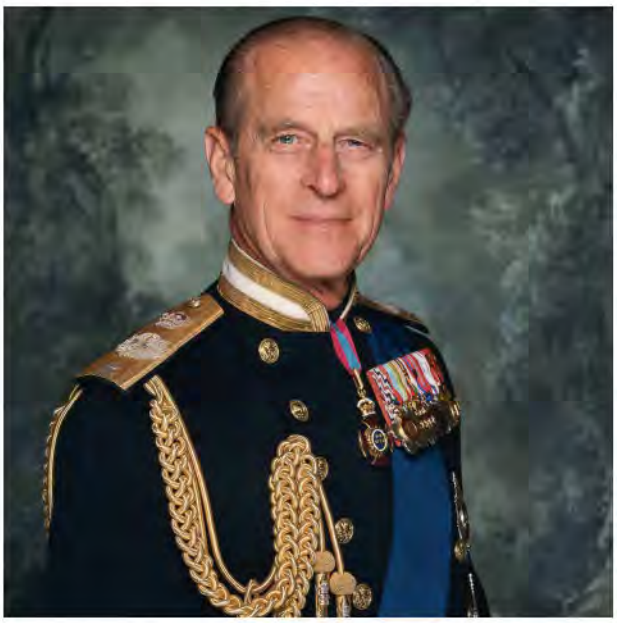
Foreword

By **Stephen M. Payne OBE FRINA FREng** Past President The Royal Institution of Naval Architects 2007-2010

It was the original intention of The Royal Institution of Naval Architects for this edition of *The Naval Architect* to commemorate HRH Prince Philip's 100th birthday. On the 9th April 2021 came the sad news that His Royal Highness had passed away within two months of reaching his centenary. Therefore, we dedicate this edition of the magazine to celebrate the remarkable life of HRH The Prince Philip, Duke of Edinburgh. Bruce Peter's article eloquently describes His Royal Highness's maritime connections and legacy which included being one of the Institution's Senior Honorary Fellows.

My first association with Prince Philip was in 1997 when I had written a tribute to the Royal Yacht *Britannia* that was about to be withdrawn. I sent the draft of the article to Buckingham Palace, which was duly returned with numerous corrections annotated in red ink by Prince Philip's personal hand. In 2004, I was introduced to him at the naming ceremony of *Queen Mary 2*, which I had designed, but discussion about the ship would have to wait until 2006 when I was nominated for that year's Prince Philip Designers Prize. At the formal event, he engaged with me in lengthy conversation about the design of the ship and how she differed from cruise ships.

I met Prince Philip on several other occasions including being seated next to him at two dinners; a New Fellows Dinner for The Royal Academy of Engineering and of course hosting him at the 2010 Annual Dinner to celebrate RINA's 150th Anniversary when I was the Institution's President. He was characteristically charming and funny, cracking the odd joke and engaging in conversation across the attendees, whilst expounding his desire to see the fire-ravaged *Cutty Sark* rebuilt as a museum ship. His security team advised me that HRH had been particularly busy that day, with engagements in both Scotland and Wales before he returned to London for the Dinner. Accordingly, I had to be aware that he would likely leave the Dinner early and I should be ready to escort



him to his car. Not any of it! The Dinner went on well past its planned time and HRH remained to the end!

Four years later in May 2014, Cunard held a celebratory lunch onboard *Queen Mary 2* to mark her 10th year in commission. HRH Prince Philip was invited as the Principal Guest and at his request I was asked to escort him around as he toured the ship. He particularly wanted to visit the crew quarters and see where they lived. He took great pains to speak with as many of the crew as possible. After the lunch, seated at the Captain's table, he was advised by his equerry that it was time to leave, to which he replied: "Do I have to; I am really enjoying my time onboard this ship!"

The Royal Institution of Naval Architects has been honoured to have HRH as a Senior Honorary Fellow and greatly mourns his passing. We send our condolences to Her Majesty The Queen and the Royal Family. ■

A LIFE OF MARITIME SERVICE

By **Bruce Peter**

His Royal Highness, The Prince Philip, Duke of Edinburgh, was a Senior Honorary Fellow of the Institution since 1955, and well known for his distinguished naval career, his vigorous support of maritime heritage activities over many decades, his great knowledge of naval history and his deep and practical interest in matters of engineering and technology.

THE DUKE OF EDINBURGH PICTURED IN 1951. SOURCE: PA

Prince Philip's naval interests were encouraged from early childhood by his uncle, The Earl Mountbatten of Burma, who was Admiral of the Fleet. As a young man during the Second World War, Prince Philip served with great distinction in the Royal Navy. Following training at Dartmouth, UK in 1939, he was first a midshipman on the battleship HMS *Ramillies* for four months, protecting convoys with the Australian forces in the Indian Ocean. There followed shorter postings on the heavy cruisers HMS *Kent* and HMS *Shropshire* in Ceylon. Back in the Mediterranean on the battleship HMS *Valiant*, he took part in the Battle of Cape Matapan off Greece in 1941 and was mentioned in dispatches. By the age of 21 he was a Sub-Lieutenant on the destroyer HMS *Wallace*, on which he was soon promoted to Lieutenant. With this rank he took part in the invasion of Sicily in 1943, his quick thinking resulting in the ship being saved from aerial attack. In August 1945, serving as First Lieutenant on HMS *Whelp*, he was present at the Japanese surrender in Tokyo Bay, which was signed onboard the American battleship USS *Missouri*.

After Prince Philip's engagement to H.R.H. Princess Elizabeth in 1947, he was an instructor at Petty Officers' Training School at Corsham in Wiltshire. Following marriage, he commanded HMS *Magpie* in the Mediterranean between 1950 and 1952. Prince Philip thereafter sought to advise on the design and outfitting of the new Royal Yacht, HMY *Britannia*, arguing for a modern design with up-to-date equipment, but instead naval tradition mostly prevailed. He also directed the removal of fixtures and fittings from the old Royal Yacht, HMY *Victoria and Albert*, for re-installation on *Britannia*. He was named Admiral of the Sea Cadet Corps in 1952 and, the following year, Admiral of the Fleet, in which role he visited the Falkland Islands, South Georgia, Tristan da Cunha, Ascension Island and St. Helena in 1956-57 on *Britannia*, becoming the first member of the Royal Family to cross the Antarctic Circle.

Prince Philip foresaw that national recovery in the post-war era would require innovation in science, technology, engineering and design – all concerns of the Royal Institution of Naval Architects – and over the ensuing decades he was strongly supportive of organisations and institutions seeking to achieve progress in these key areas. The Royal Navy and the British Merchant Navy were still the world's largest in the mid-20th century – and Britain remained a leading shipbuilding nation too – but within a decade, the 1960s shipping revolution would fundamentally change ship design and seafaring while an international realignment of ship owning and operation also gained momentum.

HMS *MAGPIE*. SOURCE: ROYAL COLLECTIONS TRUST

PRINCE PHILIP WAS CLOSELY INVOLVED IN THE DESIGN AND CONSTRUCTION OF THE ROYAL YACHT *BRITANNIA*

A keen interest in technological research has always been at the heart of Prince Philip's work as a royal. His support for innovation involved visits to laboratories and research stations all over Britain, where he invariably impressed scientists with his pertinent questions and observations. Between 1959 and 2011 Prince Philip chaired the judging panel for The Prince Philip Designers Prize, which rewarded the innovation and creativity of designers and engineers shaping daily life and in 1976, he initiated the Fellowship of Engineering at the Royal Academy of Engineering. Prince Philip took a keen personal interest in the latest developments in warship design and also was very supportive of the creation of the state-of-the-art Cunard flagship trans-Atlantic liner and cruise ship *Queen Elizabeth 2* – a vessel considered by some in the 1960s to be an unnecessary indulgence, but which came to be regarded as among the most successful and recognised passenger ships ever constructed. Much later on in the early-1990s, in his role as Commander in Chief of the Royal Marines, he was attentive to the design of the helicopter carrier HMS *Ocean*.

Prince Philip was also a noted yachtsman and was the recipient in 1949 of two racing yachts – the 'Dragon' *Bluebottle* and the 'Flying Fifteen' *Coweslip* – which were wedding presents. A further yacht, the *Bloodhound*, was acquired 1962 and it and the *Coweslip* are both now preserved next to HMY *Britannia* in the port of Leith. *Bluebottle* subsequently became a Royal Navy sail training yacht and has recently been fully restored once again to participate in regattas.

Prince Philip was Patron, President or a Member of over 750 organisations, several of which, like the Royal Institution of Naval Architects, are concerned with ships and the sea. A Trustee of the National Maritime Museum from 1948 and Patron of The Navy Records Society since 1953, he also became Patron of the *Cutty Sark* Preservation Society, which in the 1950s succeeded in rescuing and restoring the famous former tea clipper as a Greenwich visitor attraction. Prince Philip observed that while the National Trust took care of Britain's historic buildings, there was at that time no equivalent

PRINCE PHILIP PRESENTING THE 1969 COUNCIL OF INDUSTRIAL DESIGN AWARDS ONBOARD THE *QE2*. SOURCE: ALAMY

THE DUKE STRONGLY SUPPORTED THE SALVAGING AND RETURN TO THE UK OF SS *GREAT BRITAIN*, A SUBJECT COVERED IN THE THE VERY FIRST EDITION OF *THE NAVAL ARCHITECT* IN 1971. SOURCE: MATTBUCK/CREATIVE COMMONS

organisation to oversee the preservation of the nation's maritime heritage. With characteristic vigour, he lent his support to initiatives not only to save significant historic vessels and maritime infrastructure but also supported maritime historical research and scholarship. Thanks to his interventions, a great many diverse projects have come to fruition over the six decades since the *Cutty Sark* was rescued and, before Covid, Britain's heritage industry as a whole was estimated to contribute over 20 billion pounds to the economy with maritime attractions playing a significant part.

In 1970 Prince Philip supported the rescue of Brunel's early steam-powered iron-hulled trans-Atlantic liner SS *Great Britain* from the Falkland Islands, where it had been hulked, and its return on a pontoon barge to Bristol for restoration in the dock in which it had originally been built. H.M. Queen Victoria's consort, Prince Albert, had been onboard when the vessel had been floated out of the dock in 1849; Prince Philip was onboard when it was floated back into the same dock for preservation. Following the return of the *Great Britain*, in the 1980s Prince Philip next took a keen interest in the restoration of HMS *Warrior* in Hartlepool, the pioneering iron-hulled battleship dating from 1860 which is now a popular attraction at Portsmouth Historic Dockyard. The project was also supported by the Society for Nautical Research, of which Prince Philip became Patron in 1980, succeeding the late Lord Mountbatten. In 2005, Prince Philip opened the exhibition of HMS *Victory*'s foretopsail (the restoration of which the Society paid for) to mark the bicentenary of the Battle of Trafalgar and, as President of the *Cutty Sark* Trust, he closely followed ship's restoration following a fire that almost devastated the vessel in 2007.

As Senior Honorary Fellow of the Royal Institution of Naval Architects, Prince Philip has been an interested reader of its many publications, a collection of leather-bound RINA Annual Transactions dating back to the Institution's founding year in 1860 being deposited in the library at Windsor Castle. Most recently, in April 2010, Prince Philip was in attendance as principal guest at the Institution's Annual Dinner at the Royal Lancaster Hotel in London, where he met members and guests celebrating RINA's 150th anniversary. He was an Honorary Member of Lloyd's Register of Shipping's General Committee, Patron and Honorary Member of the Royal Corps of Naval Constructors and Honorary Fellow of The Institute of Marine Engineering, Science and Technology (IMarEST).

Forty years on from the *Queen Elizabeth 2*'s completion, in 2008 Prince Philip paid a valedictory visit to the great liner in Southampton before it departed for the last time, bound for Dubai and conversion into a floating hotel. In 2004, he accompanied H.M. The Queen when she named its successor, the *Queen Mary 2*, and a decade later in May 2014 he attended a gala luncheon onboard to celebrate the ship's 10th year of service. His host was Stephen Payne, the naval architect responsible for its design and a former President of the Royal Institution of Naval Architects.

HRH The Duke of Edinburgh's contributions to British and international shipping, seafaring, engineering research and maritime heritage have been extensive and invaluable. The Royal Institution of Naval Architects is honoured to have benefitted from his longstanding involvement and support and he will be sorely missed. ■

About the author

Bruce Peter is a professor of Design History at the Glasgow School of Art. Internationally renowned as a maritime historian, his published works include books on Knud Hansen, DFDS and Danish shipping lines.

ON THE BRIDGE OF *QUEEN MARY 2* ON THE OCCASION OF THE LINER'S 10TH ANNIVERSARY. SOURCE: PA

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WHAT DOES AMERICA'S NEW GREEN DREAM MEAN FOR SHIPPING?

By **Richard Halfhide**

There's a longstanding conspiracy theory that, during the 1980 US presidential election campaign, Ronald Reagan did a secret deal whereby the release of 66 American hostages being held by Iran was delayed in exchange for the unblocking of substantial Iranian monetary assets held in US banks should Reagan come to power. The fear was that the incumbent Jimmy Carter might pull off an 'October surprise' and thwart a Republican victory, despite the evidence of the polls. Lo and behold, Reagan won and with almost uncanny timing said hostages were released literally minutes after his inauguration address. It was like the plot of a B movie.

Whether or not true (and many credible witnesses attested it was) it's often the case that new American presidents can realise things that have eluded their predecessors. Donald Trump, albeit briefly, achieved the unthinkable by opening up a dialogue with North Korea, while the alacrity with which his successor, Joe Biden, has set about reversing Trump policies with some quite radical initiatives has caught off guard many who imagined his would be a cautious presidency.

Although it was widely expected that the Democrat would overturn Trump's vetoing of the Paris Agreement on Climate Change, it was one of more than 100 environmental actions that was swiftly rescinded. The so-called Green New Deal, a term clearly coined to evoke the social and economic reforms of FDR, promises a bold commitment to renewable energy. With almost hawkish zeal, the Biden administration has now turned its attention to shipping and the International Maritime Organization (IMO). In late April, it was reported that the White House plans to apply pressure to Member States to rethink its 2018 agreement of a 50% cut in overall CO_2 emissions by 2050 and instead adopt a goal of 'zero emissions' by the same deadline.

Speaking at a world leaders summit on climate change John Kerry, the US climate envoy, said: "The technologies that we need to decarbonise shipping are known to us so they need investment and they need to be scaled up," he said. "It's incumbent on all nations to send a clear signal to the industry so they will make those investments in the near future."

Quite how such rhetoric was received in the corridors of IMO, an institution that often appears to make a sport out of procrastination, is unclear, but there are already some hints as to where American policy on maritime might be leading. A Fact Sheet distributed to delegates at the leaders summit referenced: "Joining Mission Innovation's hydrogen mission and co-leading, with Denmark, a mission to reducing greenhouse gas emissions in international shipping, both slated to launch at the June 2021 Mission Innovation Ministerial."

JOE BIDEN. SOURCE GAGE SKIDMORE (CREATIVE COMMONS)

Mission Innovation (MI), is a global initiative consisting of 24 countries (plus the European Commission), which committed members to double their clean energy investments over five years in selected priority areas, leading to a collective US$4.9 billion increase in less than five years. Unsurprisingly, hydrogen and its derivatives are at the heart of many of the innovations it supports.

There are also encouraging signs that the US may throw its support behind the International Maritime Research and Development Board and its plans to create a US$5-6 billion fund for R&D into decarbonised shipping by imposing a mandatory US$2 levy on every metric tonne of fuel consumed. The subject was raised at a recent meeting of the House of Representatives Subcommittee on Coast Guard and Maritime Transportation.

Within Washington, environmentalist voices that were silenced (or simply ignored) during the Trump administration are increasingly finding a platform. The nonprofit group Ocean Conservancy wants Biden to commit to zero shipping emissions by as early as 2035, with all ships calling at US ports obliged to abide by the same clean shipping standard (the USCG's requirements for ballast treatment have given a prelude to the trouble that might cause). Intriguingly, some lobbyists are also keen to promote the argument for more nuclear-powered transportation, citing the recent progress made with micro-reactors and other advanced technologies. It's an energy source maritime is wary about even discussing but one talked up by the Biden administration for pollution-free electricity.

The US has long had an awkward relationship with international maritime, at least as far as merchant shipping is concerned, and there is sure to be some consternation at these latest efforts to start leading the drive towards decarbonisation. On the other hand, perhaps no other nation can impose quite the same leverage on those recalcitrant parties who would sooner accept yet more compromise. ■

NEWS

ALTERNATIVE FUELS

INDUSTRY LEADERS COLLABORATE ON AMMONIA GUIDANCE

CLAUS WINTER GRAUGAARD

Lloyd's Register and the Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping have announced a joint project to create guidance around the use of ammonia as a marine fuel.

The overall goal of the project – which also involves A.P. Moller-Maersk, MAN Energy Solutions, Mitsubishi Heavy Industries, NYK Line and Total – is to understand and guide how ammonia can be safely used onboard ships. The project is expected to run throughout 2021, and its first phase will include a detailed quantitative risk assessment and the development of best practices.

Despite strong interest in ammonia potential as a zero-carbon fuel, particularly 'green ammonia' derived from renewable sources, there is a growing body of concern about the chemical's toxicity, and the project will also determine the risk of fatalities from unintended releases of ammonia.

Claus Winter Graugaard, the Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping's head of onboard vessel solutions, says: "In the eagerness to decarbonise the shipping sector, proper risk management is critical and safety must not become an afterthought. This project will provide matured understanding of safety risk enabling industry guidance towards future safeguard design and adequate operational guidelines."

CLASSIFICATION SOCIETIES

CCS IS BEST FOR BULKERS

Bulk carriers classed by China Classification Society (CCS) have the lowest Deficiency per Inspection Ratio (DPI) among members of the International Association of Classification Societies (IACS), according to a report published in March.

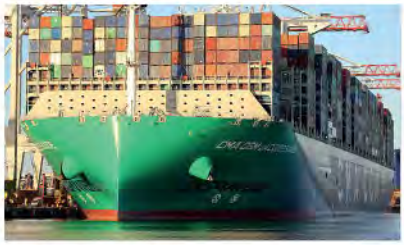
Intercargo's 'Benchmarking Bulk Carriers' report for 2019-2020 found that CCS had a DPI of 1.12, with just 2.3% detentions, despite having a 12.3% share of the dry bulk fleet. During the past year CCS's bulker fleet has also grown by 13%, reaching a total of 62.05 million gross tonnes (1,320 vessels). While its bulker fleet remains a distant second to ClassNK with 164.84 million gross tonnes (4,063 vessels), CCS can boast the highest number of very large ore carriers (VLOC) of any class society, with 68 on its books.

Among the recent additions is the 325,000dwt VLOC *Ore Zhoushan*, built at the Qingdao Beihai Shipbuilding Industry shipyard, Shandong Province. The vessel is owned by the Beijing headquartered ICBC Financial Leasing Company and will operate on a route between Brazil and China. During the naming ceremony in November, CCS president Mo Jianhui paid tribute to the hard work of CCS staff engaged in the project, despite the ongoing travails of the Covid pandemic.

He commented: "Our surveyors have gone to the front line of the project to actively solve inspection difficulties and pain points. Our team has conducted on-site technical exchanges with the shipowner and the shipyard many times to ensure that the ship, and the construction period, progressed smoothly and the ship was delivered successfully."

LNG

RECORD ORDERS FOR LNG-FUELLED SHIPS



CMA CGM JACQUES SAADÉ

The orderbook for LNG-fuelled vessels is growing at an unprecedented rate, according to information published on DNV's Alternative Fuels Insight platform.

It shows that a record 31 LNG-fuelled vessels were ordered in April, beating the previous record of 21 vessels set just a month before. The figures, which omit orders for LNG carriers using boil-off gas, include 13 VLCCs, two Capesize bulk carriers and two cruise ships. So far this year, 20% of the total vessels ordered are LNG fuelled.

Among the latest additions to the orderbook are 12 LNG-fuelled container ships that CMA CGM has contracted from China State Shipbuilding Corp. Six 15,000TEU and six 13,000TEU vessels will be delivered across 2023-2024. The French operator currently operates 12 LNG-powered vessels, which will increase to 32 next year.

The surge of orders comes despite of a recent World Bank report suggesting that LNG will only play a peripheral role in shipping's drive towards decarbonisation. It recommends that countries reconsider their support for bunkering infrastructure and suggests ammonia and hydrogen are the most promising marine fuels.

Unsurprisingly the report's findings have not been well received by the pro-LNG camp, with lobby group Sea-LNG accusing the World Bank of using research based on outdated studies (see also News Analysis).

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NEWS

BULK CARRIERS

TSUNEISHI UPGRADES KAMSARMAX DESIGN

SOURCE TSUNEISHI

Japan's Tsuneishi Shipbuilding has unveiled an LNG-fuelled version of its Kamsarmax bulk carrier design, Kamsarmax GF class, as well as completing a wider programme to upgrade all its main bulker models.

The 80,000-85,000dwt Kamsarmax GF, granted an AiP from Lloyd's Register, has a length overall of 229m and breadth of 32.26m. The vessel will be equipped with a dual-fuel engine. When running in gas mode Tsuneishi anticipates a 40% reduction in CO_2 emissions as well as significant reductions in NOx and SOx.

Tsuneishi also announced in May that it has completed development of its main bulker models to meet the requirements of Phase 3 of the Energy Efficiency Design Index and has already received orders from Japanese shipowners for the updated designs.

The ship designs updated are the standard Kamsarmax, Wide Kamsarmax, Tess-64 Aeronline, Tess-42 and the latest Ultramax design of Tess-66 Aeroline. However, the new designs will only be mandatory for vessels contracted after 2025, when EEDI Phase 3 (which requires a 30% improvement in efficiency from the 2008 baseline) enters into effect for bulk carriers.

Okumura Sachio, Tsuneishi's president, comments: "Whilst the movement in response to the global warming is being highly concerned, we would like to develop our ships in advance which have to be met with the EEDI Phase 3 regulations and provide them to our valuable customers."

RO-RO

HÖEGH ANNOUNCES 'MOST ECO-FRIENDLY CAR CARRIER EVER'

Höegh Autoliners has signed a Memorandum of Understanding with its long-term partner Xiamen Shipbuilding Industry of China for the construction of what it calls a 'zero carbon ready' car carrier.

With 9,100 car equivalent units, the Aurora Class of vessels will also be the world's largest of its type. Features will include strengthened decks and enhanced internal ramp systems to enable electric vehicles on all decks and provide flexibility for heavier project cargo. The multi-fuel engine, to be supplied by MAN Energy Solutions, is likely to initially run on LNG but with simple modifications will be capable of running on almost any future zero carbon emission fuel.

Class society DNV has already awarded the Aurora design the following notations: +1A, Car Carrier, MCDK, ICE C, E0, NAUT-OC, CLEAN DESIGN, BWM-T, TMON, BIS, COAT PSPC (B), GAS FUELLED, BATTERY (safety), F(C), Recyclable, SHORE POWER, Gas ready Ammonia (D, S, MEc, T). It is the first design in the segment to be ready for operation on carbon neutral ammonia.

Andreas Enger, Höegh Autoliners CEO, comments: "With the future of cargos and zero carbon fuels in mind, the Aurora vessel is designed for a greener future. It is the most environmentally friendly car carrier ever built."

Engers says that Höegh has set itself a target of achieving net zero carbon emissions by 2040. The first Aurora vessel is expected to be delivered in 2023.

SOURCE HÖEGH

AUTONOMOUS SHIPS

HHI DEVELOPS AI SAFETY MONITORING SOLUTION

AIP CEREMONY (AI FIRE DETECTION SYS) SOURCE HYUNDAI

South Korean shipbuilding giant Hyundai Heavy Industries (HHI) has created an Artificial Intelligence (AI) based safety management/monitoring system (HiCAMS) which could mark the next step towards autonomous ships.

The technology, which has already been granted class and flag Approval in Principle by the Korean Register and Liberian Registry respectively, is said to be the world's first classification certification for a computer vision-based AI solution for internal fire monitoring onboard a ship. Utilising image recognition/processing technology, Big Data, and advanced AI algorithms it offers a modern replacement to traditional fire monitoring sensors, which might take up to two minutes to detect a fire.

HHI sees the AI monitoring solution as the start of a series of technologies capable of detecting various accidents and emergency situations, including oil leaks, dampness and overturned containers. HHI notes that an AI-based ship safety management/surveillance system is expected to be actively applied as a prerequisite for safe navigation.

An HHI spokesperson comments: "It is meaningful in that [HHI] is the first shipbuilding organisation to incorporate artificial intelligence into the field of ship safety management... Starting with the development of this AI-based fire monitoring system, we will pre-empt the future autonomous ship era by expanding it to the entire ship safety field."

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NEWS ANALYSIS

An in-depth analysis

FUEL CHOICE STILL DOMINATING DECARBONISATION DEBATE

By: **Malcolm Latarche**, Correspondent

This year world shipbuilding is clearly staging a recovery despite the continuing dampening effect of the Covid pandemic. For owners ordering newbuilds, determining what choice of fuel to make for new ships has probably never been harder. While ammonia, hydrogen and methanol all have their supporters, realistically the current choices still boil down to 2020 compliant oil fuels, HSFO and a scrubber or LNG.

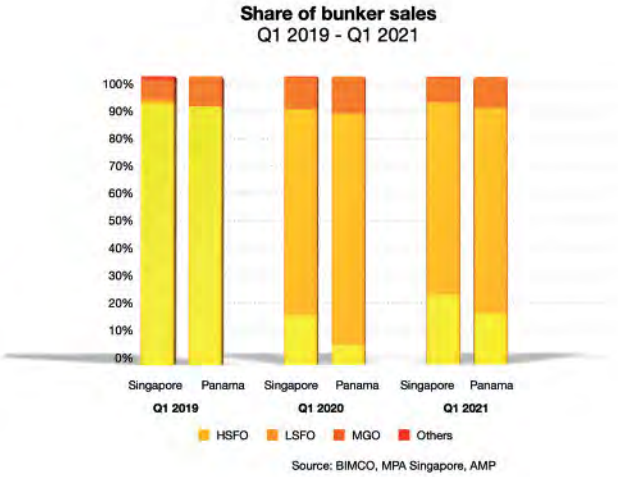
A year ago scrubbers were almost being written off as a solution to the 2020 sulphur cap. Crude oil prices collapsed and the differential between HSFO and LSFO bunkers diminished to under US$40, making the economic case for scrubbers doubtful. However, the steady rise in crude prices this year has seen the economic case for scrubbers revived.

In 2020, leading scrubber makers such as Wärtsilä, Alfa Laval and Yara were all reporting declining sales after a strong surge through 2019 as owners prepared to meet the 2020 rules. However, when reporting its 2020 financial results in April this year, Wärtsilä was more upbeat, stating that it managed a record-breaking amount of scrubber deliveries in 2020, despite Covid-19, and highlighted the continued interest in exhaust gas abatement systems as long-term solutions for the global fleet.

The company also said it had received a significant order in November from Japan Marine United for a 25MW scrubber on a new Japanese-owned VLCC to be delivered in 2022. Scott Oh, director, Wärtsilä Exhaust Treatment Asia, said of the order: "This installation is a clear indication of how important scrubbers are becoming for newbuild vessels, as they aim to keep up with shipping's tightening environmental regulatory landscape. We are confident that the industry understands both the power of exhaust gas cleaning technologies as compliance solutions for today, but also to meet a range of challenges beyond sulphur."

Also in April, BIMCO's website featured an analysis of bunker sales for Q1 2021 which showed a large increase in sales of HSFO. In Singapore, sales were up 47.2% from Q1 2020, while smaller increases in HSFO occurred in other bunker hubs.

The increase of HSFO sales is indicative of the success of scrubber sales. BIMCO says the pace of scrubber fittings



has slowed since its peak in January 2020, during which 259 ships with a total capacity of 33.4 million dwt either had a scrubber installed or were delivered with one already onboard. In the first three months of this year, 228 ships have joined the number of scrubber-fitted ships. Of these, two-thirds (153) were newbuilds being delivered with a scrubber already fitted and the remainder retrofits.

BIMCO concludes that although the pace of scrubber installations has slowed, the economic case for a scrubber is still strong even if the spread between HSFO and VLSFO has still a long way to go before it reaches the levels of January 2020.

The alternative to scrubbers – LNG-fuelled ships – are also enjoying success. Classification society DNV said orders for LNG-powered ships hit a new record high in April of 31 vessels, following 21 orders in the month before. "That brings the year-to-date order count to 80 ships, with the majority being large vessels trading globally. That's nearly 20% of the orders YTD with LNG fuel," Martin Wold, principal consultant at DNV, said. DNV records show that aside from LNG carriers, 199 LNG-powered ships are now in operation with 295 on order. Still someway short of the more than 4,000 vessels with scrubbers but indicative of growing acceptance among owners.

That sentiment was under attack from an unlikely quarter when the World Bank published a report in

mid-April strongly critical of the support for LNG as a marine fuel. Given that governments and the EU in recent times were so much in favour of promoting LNG and aiding in bunkering infrastructure building, the World Bank's recommendation that countries should avoid new public policy that supports LNG as a bunker fuel, reconsider existing policy support, and continue to regulate methane emissions was not without criticism.

Strong support for LNG came from organisations such as the Society for Gas as a Marine Fuel and Sea-LNG. The latter issued a strong rebuff to the World Bank report, saying that it risked stifling innovation and used outdated data in reaching its conclusion. "To suggest that investments not be made in the LNG sector is unwise and will prolong the use of higher emissions fuels and slow down shipping's decarbonisation. SEA-LNG believes strongly that the transition to future fuels must not follow this prescriptive approach. It is far too early to decide what the real potential of various alternatives fuels will be for a highly complex, hard-to-abate, global industry," said the Sea-LNG statement.

Industry sentiment is more sympathetic to those defending LNG than the World Bank, with many having said recently that support for other future fuels is not misplaced but their readiness for use in the immediate future is more than a little optimistic. ■

WÄRTSILÄ HAS BOASTED OF RECORD SCRUBBER DELIVERIES IN 2020

NEWS EQUIPMENT

SAFETY

VIKING ACQUIRES HYDROPEN CONTAINER FIRE-FIGHTING SYSTEM

Viking Life-Saving Equipment has acquired HydroPen, the Danish company which developed the unique HydroPen system for tackling container fires.

Founded in 2016 by Martin Winkel and Jesper Rosenfeldt Hansen, HydroPen's technology makes it possible to directly extinguish container fires at any height onboard cargo vessels. Designed to be operated by just a single crew member, the system consists of telescopic poles to which the HydroPen itself, a water-based drilling machine, is attached via wire and then hoisted up to the burning container and locked into place.

Using only pressure from the fire mains system, the HydroPen drills through the container door in around 10 seconds and begins shooting water inside (the system is also suitable for foam or CO_2). Meanwhile, the rotation from its turbine creates a water shield that protects the crew and prevents the fire from spreading. After the fire has been extinguished the HydroPen can be dismantled as easily as it was set up.

Viking already had a long-standing interest in the product, having become its exclusive distributor shortly after HydroPen was launched at SMM 2018. The acquisition comes as efforts to curb the alarming trend in container ship fires continue. According to marine insurers TT Club a container fire occurs on average every 60 days, although some estimates have suggested the true figures could be even higher. The International Union of Marine Insurance is among those calling for improved design and firefighting equipment for Ultra Large Container Ships.

PROPULSION

NAKASHIMA PROPELLER TAKES MAJOR STAKE IN BECKER MARINE SYSTEMS

After a relationship going back more than 40 years, Japan's Nakashima Propeller Co has consolidated its long-term strategic partnership with shipbuilding supplier Becker Marine Systems with the announcement in April that it has taken a majority stake in the German company.

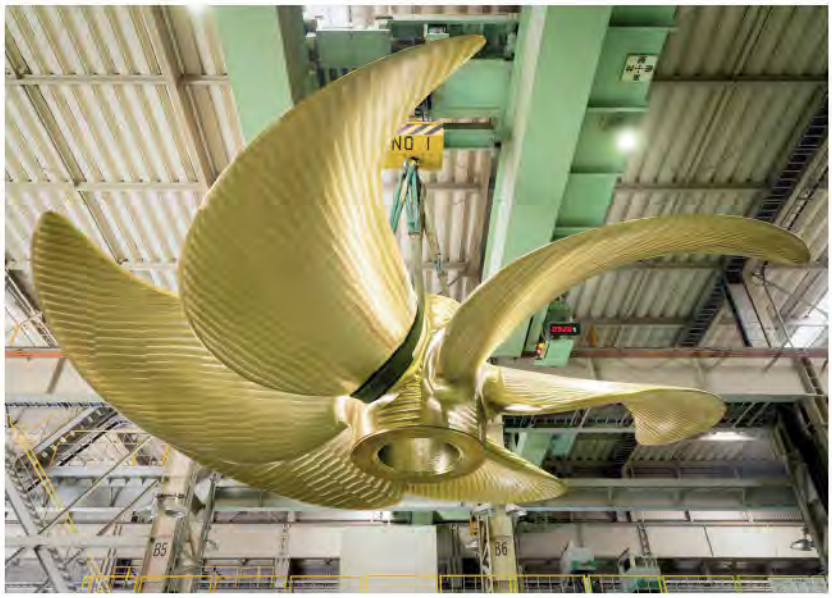
The merger, which has been under discussion for some time, will allow the two companies to make more effective use of the combined product portfolios for aft ship solutions. In addition to Nakashima's propellers and bow thruster systems, and Becker's manoeuvring systems and energy-saving devices, both companies also have state-of-the-art CFD departments that will now work more closely together.

Nakashima's president, Takayoshi Nakashima, says: "I strongly believe that the relationship and trust which both families and management teams built over 40 years enables us to reach this agreement successfully. We will make a significant contribution to total optimisation for propulsive performance as well as manoeuvring performance to our customers during the entire life cycle of ships."

"We have gotten to know Nakashima Propeller as a much respected and reliable partner through decades of cooperation," comment Dirk Lehmann and Henning Kuhlmann, joint managing directors at Becker Marine Systems, who will continue in their current roles.

Also in April, Nakashima announced the acquisition of Shoyo Engineering (SEC), an international supplier of shaft horsepower meters.

SOURCE NAKASHIMA PROPELLER



HYDROGEN CONTAINMENT

CLASSNK APPROVES HYDROGEN CARRIER TANKS

Kawasaki Heavy Industries (KHI) has been granted Approval in Principle (AiP) by ClassNK for a 160,000m³ hydrogen cargo containment system (CCS) it is developing.

The CCS for which the AiP was obtained will contain cryogenic liquefied hydrogen, reduced to a temperature of –253°C and one eight-hundredth its initial volume. At 40,000m³ per tank, the planned vessel will have the largest capacity of its kind worldwide used in liquefied hydrogen marine transport. It was developed using design, construction and safety technologies during construction of the 1,250m³ test project *Suiso Frontier*, also built by KHI, which entered service earlier this year.

- Enables transportation of cryogenic liquefied hydrogen in large amounts thanks to tank capacity on par with tanks used on large liquefied natural gas (LNG) carriers
- Utilises an independent, self-supporting design with a structure capable of responding flexibly to thermal contraction that occurs when loading cryogenic liquefied hydrogen
- A newly developed, high-performance heat insulation system that mitigates boil-off gas (BOG) which occurs in response to heat ingress
- Designed to effectively utilise boil-off gas as fuel to power the ship, thus contributing to reduced CO_2 emissions from liquefied hydrogen transport operations

ClassNK's AiP follows examinations confirming the CCS satisfies IMO's IGC Code and Interim Recommendations for Carriage of Liquefied Hydrogen in Bulk. It also meets the requirements of ClassNK's 2017-published 'Guidelines for Liquefied Hydrogen Carriers' and passed a risk assessment based on Hazard Identification Study (HAZID) methods.

KHI developed the CCS as part of a project supported by the NEDO Technology Development Project for Building a Hydrogen-based Society, as well as other initiatives involved in Japan's drive to become a hydrogen-based society. It is hoped the planned vessel will commence commercial operations in the mid-2020s.

SOURCE KAWASAKI

MOORING ROPES

ROPE TENSION SENSOR WINS RINA-LR SAFETY AWARD

A sensor-enhanced mooring rope developed by Wilhelmsen Marine Products has won this year's RINA – Lloyd's Register Maritime Safety Award, it was announced in May.

Known as Timm's Smart Ropes, the digital mooring system is comprised of HMPE rope, manufactured as part of the company's Timm Acera range, but with an embedded load sensor. The wireless sensor relays real-time information to the bridge to ensure the mooring ropes have the right tension, while serving as a warning system for premature wear of ropes and, in theory, making unexpected rope failures a thing of the past. Having been first launched at SMM 2018, in October last year operators Synergy Ocean, Viking Cruises, Berge Bulk and Finnlines were announced as the first to employ the system.

The Smart Ropes system is complemented by the Timm Line Management Plan, an app-based platform for recording mooring hours, performance inspections and holding relevant documentation. It is a requirement of OCIMF that vessel mooring information is accessible, on ship and shore, from a single source.

Commenting on the award, Magnus Dickens, venture lead for Wilhelmsen Marine Products' Open Innovation, tells *The Naval Architect*: "It is incredibly gratifying to be recognised in this way by the Royal Institution of Naval Architects. It is especially motivating for all of us working with Smart Ropes, and the Line Management Plan, to win in this category, maritime safety.

"At the end of the day, our system is not technology for technology's sake, it is about finding practical, proven solutions to real-life problems, helping to make life at sea, and in port, both safer and more efficient."

Statistics published by the European Harbour Masters' Committee indicate 95% personal injury incidents are caused by ropes and wires, 60% of which take place during mooring operations.

BALLAST WATER TREATMENT

ECOCHLOR LAUNCHES FILTERLESS BWMS

US-headquartered ballast water management system (BWMS) manufacturer Ecochlor has launched the EcoOne, a new system using filterless technology, for what the company believes to be a simpler and more reliable solution.

"Why filterless? The short answer is because the customers asked us for it," explains Andrew Marshall, Ecochlor's VP of business development. "Some shipowners require a BWMS with a reliable high volume pumping rate that's not going to be impacted by heavy challenge waters with a lot of salt and sediment... The requirement as far as we were concerned was that it had to be done properly."

The conventional ballast treatment options of UV radiation or electrochlorination (EC) are unable to achieve the desired efficacy when used without filters, putting the equipment itself at risk. The hypochlorite generated by EC systems will react chemically with all organic matter, meaning that dirtier waters require heavier doses, and the additional power requirements can in turn damage the ballast tank coatings.

By contrast, the EcoOne uses the company's patented chlorine dioxide (ClO_2) treatment technology, which primarily reacts with living organisms, regardless of sediments or turbidity, meaning its power consumption remains much lower. Moreover, because ClO_2 naturally dissipates in water it is generally less harmful to the environment. However, in the interests of environmental protection, due to a small amount of salty discharge, filterless operation will be restricted, with an EcoOne Hybrid system for freshwater that would combine a filter with a lower dose of ClO_2.

"What we are expecting with a lot of our customers is they take a full-flow operation in marine and brackish water and perhaps a half-flow for those rare occasions when theory may need genuine freshwater (less than 1 PSU) operation. Only having to install one filter for a hybrid system also reduces the cost of operation," says Marshall. "The system automatically monitors [salinity] so it's not even possible for the crew to make a mistake and use it in the wrong mode."

Land-based type approval testing, independently conducted by DNV, has now been completed for both IMO and USCG requirements. The ship-based tests, for which Ecochlor has chosen to use two vessels, started in September and is expected to be completed this month. Relevant certification from IMO, USCG, class and flag administrations should be issued later this year and early 2022.

SOURCE ECOCHLOR

OPINION

DON'T ASK WHO TO BLAME, BUT ASK WHAT CAN BE DONE BETTER!

By **Nick Bialystocki, MRINA** Marine Engineer, Antares Maritime Services

Ships and shipping for the vast majority of the world are behind the scenes, and we've all been living with it quite well. However, the grounding of MV *Ever Given* in March in the Suez Canal bounced our industry to the top of the news headlines, in almost every country. The reason is obviously the impact of the canal blockage on the world logistic supply chain, noting that about 10-12% of all goods are transported via the Suez Canal.

Along with the large-scale coverage in mainstream media, the incident was discussed in almost every WhatsApp group channel, and on Telegram, Facebook, LinkedIn etc. Naturally, the discussions in the above and other social media were more opinionated and less professional, due to the fact that most of the information related to the case was and still is unknown.

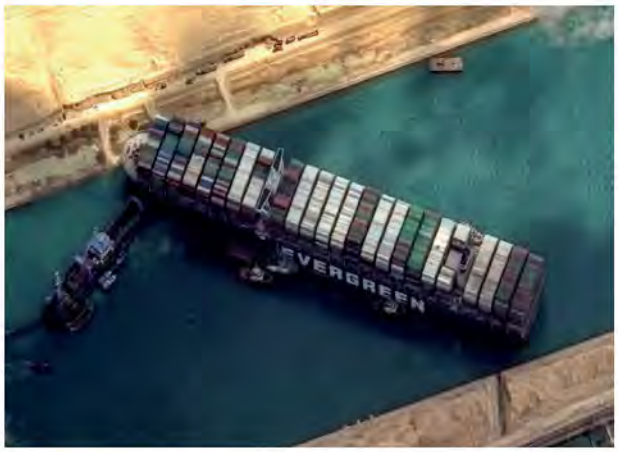
To give few examples, the investigators of the incident will need to collect evidence in various means such as interviewing the Master of the vessel, the Pilot and any crew that was on duty. They will also take records from the bridge and engine log books, printouts from course recorder, bell book and engine manoeuvre log. They will also try to obtain the VDR recording of several additional sensors, and any other relevant information regarding the vessel and the ship's management.

On the other hand, what were known to the general public are the general particulars of the vessel (partially), its track and, to some extent, the weather conditions. Based on that only, it was frustrating to read thousands of comments accusing mostly *Ever Given*'s captain, including memes and jokes on his account.

It seems that the downsides of the social media, which have been known onshore for many years, took over the shipping for a week, and it was sad to see the insensitive attacks of the captain by blaming him for the situation caused.

Accidents in shipping unfortunately still happen, from time to time, and cannot be completely avoided, albeit that thanks to regulations and learning processes the number of accidents over the years has reduced significantly. It should be remembered that at the same time the world's gross tonnage, which represent the factors of number of vessels and their size, has been increasing.

Therefore, it is fairly safe to say that on a top level view the industry is on the right track to reduce accidents, and it is attributed to, among other reasons, the implementation of the right processes in accident investigation. Luckily, the right process doesn't include



THE SIX-DAY BLOCKAGE BECAME AN INTERNATIONAL CAUSE CÉLÈBRE

statement from social media.

In order to learn from accidents, there is a "no blame" policy applied in shipping!

"No pre-judgement"!

There is, however, a professional indecent investigation, and the liabilities of the various parties involved. These terminologies are critical for the accident investigation and for improving safety of ships and ship operations.

For the *Ever Given* case there may be several entities that bear liability for the incident, and it's paramount to understand that no one entity nor person are blamed, as we are here to learn and improve. These include Suez Canal Authority, the shipowners, managers, charterers, crew and there might be more depending on findings of the investigation.

On top of this, we should not forget the responsibility of the international organisations led by IMO and ILO, as well flag states and port states in establishing regulations and controlling them.

Epilogue – The vessel was refloated, the canal was reopened and the shipping went back to normal behind the scenes, and hopefully for the next accident we will improve our patience and avoid pre-judgement. ■

Editor's note: *Ever Given* was subsequently impounded by the Egyptian government for the failure of the ship's owner, Shoei Kisen Kaisha, to pay the US$900 million damages demanded by the Suez Canal Authority. At the time of going to press it remains anchored in the Bitter Lakes stretch of the waterway, awaiting the outcome of ongoing negotiations.

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JAPAN

MOL'S SAILS RISE TO THE CHALLENGE

By **Richard Halfhide**

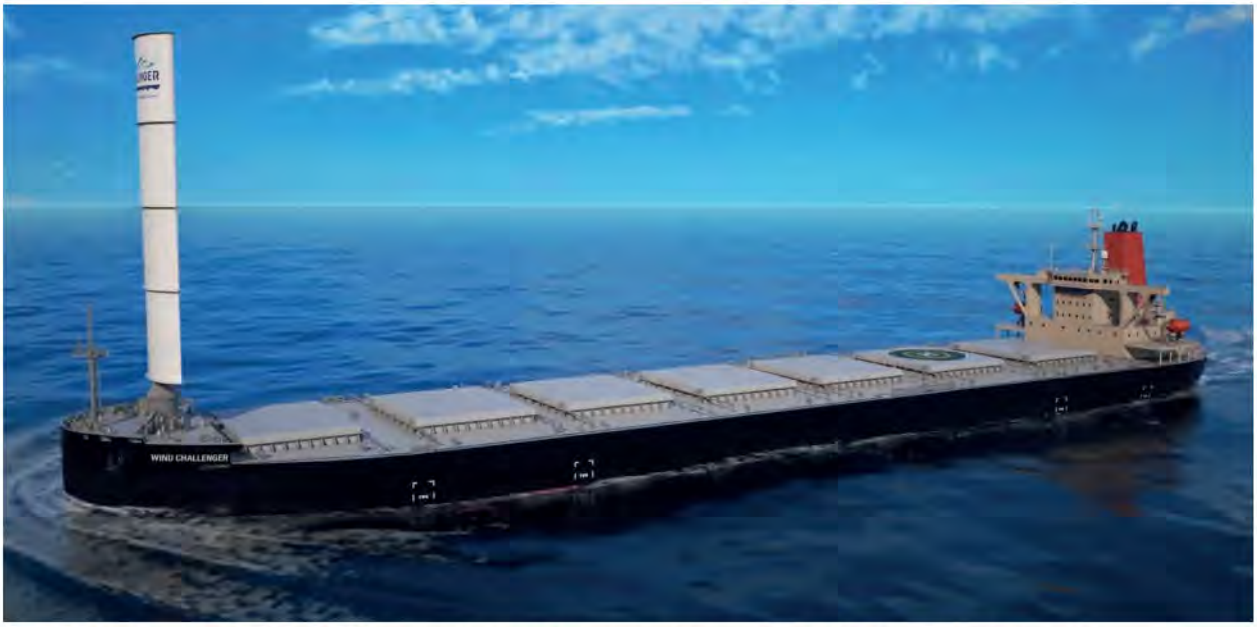

FIG 1: THE FIRST WIND CHALLENGER BULK CARRIER IS SCHEDULED FOR DELIVERY IN THE SECOND HALF OF NEXT YEAR. SOURCE: MOL

Japanese operator Mitsui OSK Lines (MOL) has had wind propulsion in its sights for a long time. In 2009, it joined forces with the University of Tokyo in forging the Wind Challenger Plan to explore the energy saving potential of sails on its vessels. However, with the global economy still mired in recession after the events triggered by the collapse of Lehman Brothers the year before, MOL decided instead to prioritise the more expedient option of slow steaming and the plan was placed on the back burner.

Then, in 2013, it received a fresh injection of support when it was chosen to receive a 'Subsidy for Next-generation marine environment-related technology research' by Japan's Ministry of Land, Infrastructure, Transport and Tourism. Further impetus came with the 2015 Paris Agreement, when MOL began considering the potential for GHG reduction by using wind for the generation of renewable hydrogen. Two years later, in collaboration with shipyard partner Oshima Shipbuilding, the Wind Challenger Plan had evolved into the Wind Challenger Project.

Bulk carrier

The project's primary aim is to develop an extraordinarily large rigid wing sail (height: 60m, breadth: 15m, thickness: 3m) for a bulk carrier, located at the forecastle of the ship, which can be rotated according to the wind direction or retracted telescopically to a reef sail. After being granted Approval in Principle (AiP) by ClassNK in October 2019, the concept moved to the detailed design stage and in late 2020 came the announcement that MOL had reached a deal with Tohoku Electric Power Co for an 87,396dwt coal carrier. Based on the Wind Challenger concept, the Oshima-built vessel is scheduled for delivery during the third or fourth quarter of 2022.

Principal particulars	
Vessel Type: Bulk carrier	
Length (OA):	235.00m
Breadth:	43.00m
Depth:	20.05m
Draft:	12.80m
Dead Weight:	87,396t
Cargo Space:	7 holds, 7 hatches
Sail Area (H*B=54m*15m x 1 Sail):	Approx. 810m^2 (max.)
Main Engine (B&W 6S60ME):	9,180kW x 84.0rpm
Service Speed (85%MCO, 15%SM):	14.3knots
Fuel Consumption:	36 t/day
Complement:	28 Persons

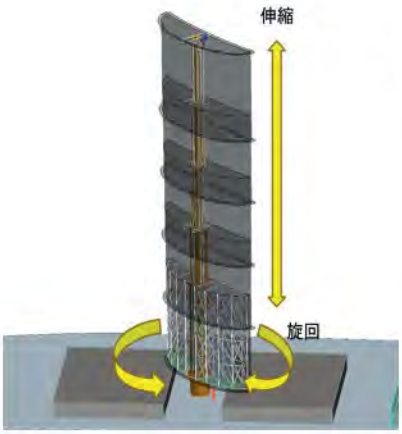

FIG 2: WIND CHALLENGER SAILS. SOURCE: MOL

According to the project's research, the initial ship will save an estimated average of 4-7% in fuel. MOL tells *The Naval Architect* that this single sail configuration should have little effect upon the vessel's hydrodynamics. However, it is planned that subsequent ships could be fitted with as many as four Wind Challenger sails, for a combined average fuel saving of 14-28%, which will require more careful stability considerations, particularly the righting moment. MOL and Oshima plan to run further verifications of the system's GHG reduction effects ahead of the 2022 delivery date, which will factor in the motion characteristics, main engine and the customer's operational patterns. The remaining power will come from what MOL calls "conventional fuel" although does not specify whether this would be HFO with scrubbers or Low-Sulphur Fuel Oil.

The sail itself (see Fig. 2) consists of a rigid wing sail of closed skin with a crescent wing section. A telescopically retractable steel spar and fibre reinforced polymer (FRP) blade will be lifted by a hydraulic cylinder inside the spar, with the spar's rotation enabled by a mechanical gear on the upper deck. Concept illustrations suggest the sail will be reduced to around one quarter of the surface area when in reef sail mode, which would be deployed during strong winds or when the vessel is in port. The sail area and direction will be automatically controlled.

Zero emission concept

But while the Wind Challenger's ambitions might appear comparatively modest that's really only half the picture. In parallel, MOL has been developing a zero-emission sailing ship concept, a project known as Wind Hunter, which will take surplus wind energy acquired by the sails and convert it into hydrogen.

A Wind Hunter ship would have two methods for propulsive operation. In the event of strong winds, excessive energy, i.e. greater than that required for the ship's cruising speed, would generate electricity driving an electrolysis device and thereby hydrogen gas. This gas would in turn be attached to toluene held in storage to create methylcyclohexane (MCH). Despite being far less regularly mentioned in discussions of Power-to-X options, MCH offers superior energy density to liquid hydrogen without the toxicity of ammonia while being capable of storage as a liquid in normal conditions.

The MCH would then be stored in a dedicated tank (see Fig 3.). Should there only be weak winds then the energy deficit required to achieve cruising speed would be supplied by a fuel cell via electric motor-driven propellers. This fuel cell would be powered by hydrogen gas derived from the MCH.

Presently, Wind Hunter is in Phase 1 of its development; a test project in which a water electrolyser, hydrogen storage alloy, fuel cell, generator turbine and electric propeller have been installed on a 40ft yacht for a series of exercises. This stage, which is expected to be completed at the end of this year, will be followed up to 2024 by a program of larger demonstrations, as well as the preparation of an optimised weather routing system. MOL will also seek to collaborate with various authorities and discuss with candidate shipyards. It is projected that the first Wind Hunter vessel would enter service in 2030. ■

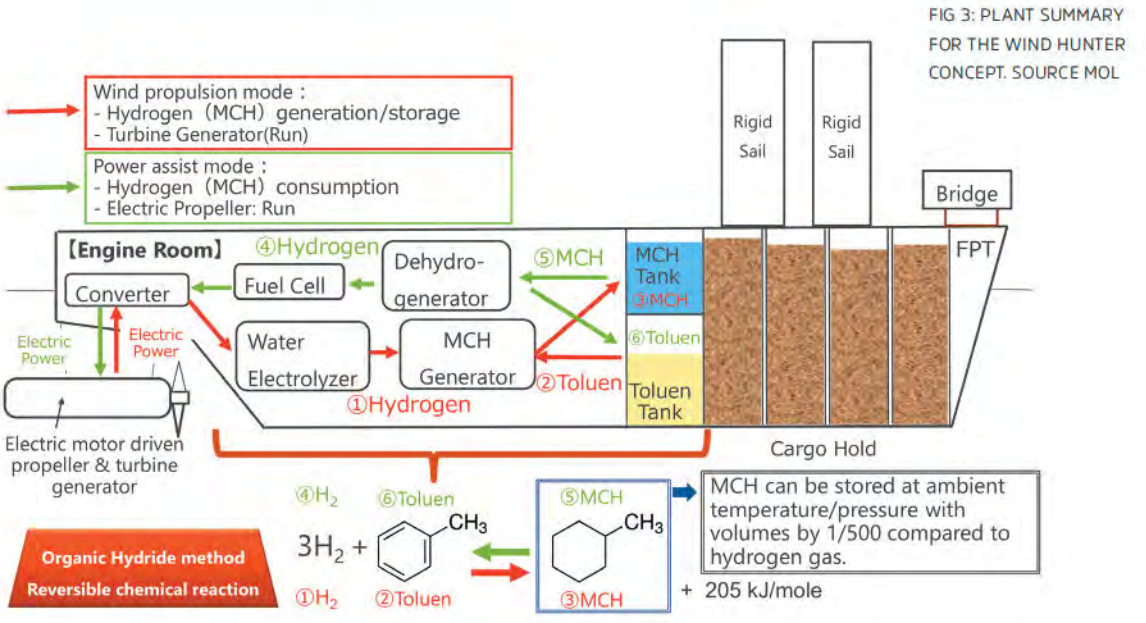

FIG 3: PLANT SUMMARY FOR THE WIND HUNTER CONCEPT. SOURCE MOL

CHINA

70 YEARS OF CHINESE SHIPBUILDING

A history of developing China's shipbuilding industry, and its expansion in the last 40 years

By **Ship Economy & Trade**

A symbol of a country's industrial level, shipbuilding has a reputation for being the peak of comprehensive industry. Looking back on the 70 years since the founding of the people's Republic of China, a proclamation announced by Mao Zedong at Tiananmen Square, Beijing, in October 1949, China's shipbuilding industry has gone through the main phases of development, starting from its ruins, opening up to the world, experiencing global development, reinventing itself and achieving considerable growth.

Starting from the ruins

The Chinese shipbuilding industry, and its development, has distant origins and a long history, which once saw famous Chinese navigator Zheng He lead seven voyages to the West during the Ming Dynasty in the 1400s. However, in modern times, up until the eve of the founding of the People's Republic of China in 1949, there were only 20 major shipyards in the country, with less than 20,000 employees. The birth of this new China brought with it a new lease of life to the shipyards and even China's shipbuilding industry.

In the three years following the inception of China as it's now known, the country's shipbuilding industry rapidly recovered and developed, and the country's Jiangnan Shipyard was rejuvenated from its ruins. After nearly 10 years of development, in November 1958, China's first 10,000dwt oceangoing cargo ship, *Yuejin*, was built in Dalian Shipyard, but the ship adopted a complete set of design blueprints and equipment materials imported from the Soviet Union.

By comparison, the bulk carrier *Dongfeng*, which was built by Jiangnan Shipyard at the same time, bears more significance. It was the first 10,000dwt oceangoing ship that the Chinese people attempted to design and build independently, adopting entirely domestic equipment. The ship was successfully constructed, creating a precedent for China to design and build domestic vessels of its scale, and laying a foundation for the country's subsequent large-scale construction of ships over that 10,000dwt mark.

Opening up to the international market

In the 1970s, China began to reform and open up, and China's shipbuilding industry consequently started to dip its feet into the international shipping market. In the winter of 1977, Deng Xiaoping, who became paramount leader of the People's Republic of China following Mao Zedong's death in 1976, gave the instruction that Chinese ships should export and enter the international market.

DONGFENG, THE FIRST 10,000DWT OCEANGOING SHIP TO BE DESIGNED AND BUILT BY A CHINESE SHIPYARD

For China's shipbuilding industry, which for a long time had been reliant upon state plans to arrange production, this was not easy. Neighbouring country Japan's shipbuilding tonnage reached 1.746 million tonnes in 1956, becoming the world's largest shipbuilding country. By 1981, South Korea had grown into the second largest shipbuilding country in the world after Japan. However, in the late 1970s, the global shipbuilding industry collapsed into a low ebb, and the orders of Europe, America, Japan and other shipbuilding industries fell and suffered heavy losses.

At this time, with the help of Chinese people globally, the country's shipbuilding industry gradually opened the door to the international market. In 1979, Bao Yuxing, younger brother of influential Hong Kong maritime businessman Bao Yugang and chairman of Liancheng Shipping Company, agreed that two 27,000dwt bulk carriers would be Chinese built. A

MAO ZEDONG FORMALLY PROCLAIMED THE FOUNDING OF THE PEOPLE'S REPUBLIC OF CHINA IN OCTOBER, 1949 SOURCE YANG YANG

THE FIRST BULK CARRIER TO BE BUILT ACCORDING TO INTERNATIONAL STANDARDS FOR EXPORT BY CHINA'S SHIPBUILDING INDUSTRY

27,000dwt bulk carrier, later named *Great Wall*, was successfully delivered in January 1982, becoming the first bulk carrier constructed according to international standards with self-management of its export by China's shipbuilding industry. With the opening of the Hong Kong market, Chinese built ships began to export to European and American markets, and in May 1982, China Shipbuilding Corporation, the predecessor of China State Shipbuilding Corporation Ltd. (CSSC), was established.

In the 16 years that followed, the ships exported by China Shipbuilding Corporation accounted for 55% of its total output. Vessels built in China were exported to many countries in the world, including the US, Japan, Germany, Britain, France and other developed countries, and exporting ships became the main business of China's shipbuilding industry.

"THE SHIPBUILDING INDUSTRY IS IN ITS MOST DIFFICULT PERIOD SINCE ITS REFORM AND OPENING UP, WITH A SERIOUS SHORTAGE OF ORDERS AND FALLING PRICES. SHIPBUILDING, ITS SUPPORTING BUSINESSES AND NON-SHIPBUILDING ENTERPRISES ARE ALL FACING SEVERE CHALLENGES."

In the 1990s, China became the third largest shipbuilding country in the world after Japan and South Korea. In 1990, Jiangnan Shipyard's annual shipbuilding output exceeded 200,000tonnes, and it became known as China's primary shipyard. However, in the last few years of the 20th century, the impact of the Asian financial crisis in 1997 on the shipping and shipbuilding industries began to show. A former leader of China Shipbuilding Group once described the scene as such: "The shipbuilding industry is in its most difficult period since its reform and opening up, with a serious shortage of orders and falling prices. Shipbuilding, its supporting businesses and non-shipbuilding enterprises are all facing severe challenges." On 1 July 1999, after 17 years, China Shipbuilding Corporation completed its historical journey, and two major shipbuilding conglomerates, China State Shipbuilding Corporation (CSSC) and China Shipbuilding Industry Corporation (CSIC), fully came into being.

Exploring a new path for development

After 1992, China further accelerated the pace of its opening up and reform. During this period, mainland China began to explore listing and financing large enterprises overseas. In 1993, six mainland industrial enterprises issued H shares in the main board stock market of Hong Kong. This acted as the prelude for overseas listing of Chinese enterprises, and among these companies was Guangzhou Shipyard International Company Ltd (GSI). In August 1993, GSI's stock was listed on the Hong Kong stock exchange, becoming China's first overseas listed shipbuilding enterprise and providing a blueprint for China's shipbuilding industry to accelerate its operating capital.

After mainland shipyards gradually deepened exchanges and interaction with foreign shipyards, China Ocean Shipping Company (COSCO) and Kawasaki Heavy Industry (KHI) signed a joint venture for a shipbuilding project in December 1995. This joint venture for the construction of Nantong Shipyard, later known as Nantong COSCO Kawasaki (NACKs), became an important practice for China in introducing foreign capital to the country.

In 1999, Jiangsu Yangzijiang Shipyard Co., Ltd, a product of the restructuring of Yangzijiang Shipyard – a subsidiary of today's Yangzijiang Shipbuilding Group Co., Ltd – was officially listed, becoming the

DA PENG SUN, CHINA'S FIRST SELF-BUILT 147,000M³ MEMBRANE LNG CARRIER

first restructured enterprise of China's state-owned shipyards. At that time, of Yangzijiang Shipyard's total share capital, state-owned shares accounted for 30% and employee-owned shares accounted for 70%. The shipyard cancelled its shiprepair business, relocated its shipbreaking sector and, by utilising the funds raised from integrating these businesses and its restructuring, the company fully developed its shipbuilding industry.

In these first two decades of its reform, China's shipbuilding industry achieved significant change, from being sealed off to opened up, from domestic to international markets. The country experienced the test of fierce competition in the international market, while at the same time improving its shipbuilding capacity, expanding

its influence globally, and solidifying its position as an important force in the international shipbuilding industry.

Promoting innovation and development

Since 2000, the world shipbuilding market gradually shook off the influence of the Asian financial crisis, ushering in a rare market climax. In 2001, China joined the world trade organisation (WTO). During this period, many state-owned companies built and expanded several large shipbuilding enterprises. Private enterprises, joint ventures and local enterprises in Jiangsu, Zhejiang, Shandong, Liaoning, Fujian and other provinces developed rapidly. A number of large and medium-sized shipyards and ship supporting enterprises were newly built, and China's shipbuilding industry became increasingly bigger and stronger.

In November 2001, Shanghai Waigaoqiao Shipbuilding Co., Ltd. was officially put into operation, and completed the construction of 100 ships within seven or eight years after the establishment of its factory. Later, in 2007, China's shipbuilding industry received breakthrough orders of 100 million tonnes of new ships throughout the year, becoming the first country in the history of shipbuilding in the world to receive an annual order volume of this quantity. With the development of private companies and other state-owned shipbuilding enterprises, China's shipbuilding industry formed a pattern of dividing its shipbuilding world into three parts: two major shipbuilding groups, other state-owned shipbuilding enterprises and private enterprises.

In April 2008, *Da Peng Sun*, China's first self-built 147,000m^3 membrane type LNG carrier, was delivered at Hudong Zhonghua Shipbuilding (Group) Co., Ltd. In 2015, the world's first 172,000m^3 membrane type LNG carrier, *Papua*, built by Hudong Zhonghua, was named. It was the first LNG export carrier designed and built by China, which had completely independent intellectual property rights and met international standards.

A start for cruise ships

Among its crowning jewels, large cruise ships were the last to be picked up by China's shipbuilding industry. In February 2017, CSSC signed a Memorandum of Agreement (MoA) for the construction of China's first large domestically built cruise ship with US cruise ship operator Carnival Group and Italy's Fincantieri group. Over a year later, in November 2018, CSSC, Carnival and Fincantieri signed a design and construction contract for two + four Vista class cruise ships with a gross tonnage of 135,000tonnes, and, in a true sense, China's first domestic large cruise ship entered a substantive design and construction stage of production.

In terms of promoting the localisation of cruise manufacturing, in April 2017, China Merchants Industrial Holdings Co., Ltd., a subsidiary of China Merchants Group, signed a polar exploration cruise ship construction contract with SunStone Ships, a US cruise shipowner. On 6 September 2019, China's first polar exploration cruise ship, *Greg Mortimer*, constructed by China Merchants Heavy Industry (Jiangsu) Co., Ltd., another subsidiary of China Merchants Group, was named and delivered.

A bumpy road

The road to development is not always smooth. In 2018, China's shipbuilding completed 34.58 million deadweight tonnes nationally, down 14% year-on-year, and the country's shipbuilding enterprises achieved a total profit of 9.14 billion yuan, a year-on-year decrease of 35.5%. Affected by the weakening recovery of momentum of the world's economy and shipping market, as well as the depth of adjustment required for the new ship market, China's shipbuilding industry was facing a grim situation.

CHINA'S FIRST POLAR EXPLORATION CRUISE SHIP, *GREG MORTIMER*
SOURCE SUNSTONE SHIPS

To this end, China's shipbuilding industry began to move towards a new direction of development; the design and construction of intelligent ships, and the construction of intelligent production lines. Up to now, the world's first smart ship, *Dazhi* (*Great Intelligence*), the world's first smart, very large ore carrier (VLOC), *Mingyuan* (*Pacific Vision*), and the world's first smart, very large crude carrier (VLCC), *Kaizheng* (*New Journey*) have all been delivered. Further to this, ship hull, assembly and welding, pipe outfitting and other intelligent workshops are under construction and expansion.

After 70 years of development, China's shipbuilding industry has been able to design and build all kinds of modern ships that meet the specifications of any classification society in the world, international general technical standards and safety requirements, and are seaworthy in any shipping area globally. The country has not only realised independent batch construction of bulk carriers, oil tankers and container ships, but also made historical breakthroughs in LNG carriers, various marine engineering equipment, manned deep submersibles, and other fields.

There is no end to innovation and development. In the future, China's shipbuilding industry will strive to strengthen its innovation, optimise its layout and adjust its structure, and improve quality through intelligent transformation, so as to help China become an influential shipbuilding power globally. ■

A version of this article was originally published in the Chinese publication 'Ship Economy & Trade'

MALIN'S SEMI-SUB BARGE FOR THE T26 PROJECT. SOURCE: MALIN ABRAM

HEAVY LIFT

LOOKING AT THE BENEFITS OF SEMI-SUBMERSIBLE BARGES

By **James Bowie**, Engineering Director, Malin Abram
& **Chris Dunn**, Principal Naval Architect, Malin Abram

There are occasions, especially in the engineering industry, where the most appropriate equipment for the project may not be available, cost effective or even exist. This conundrum can make what initially seems like a simple scope, a great deal more complicated; however, it equally presents an opportunity, opening the way for innovation and progressive engineering solutions.

A case study example of a float-off project is looked at in this article, taking a large vessel from its build hall, loading it out onto a barge and subsequently floating the vessel off where it may be towed to a drydock. The correct semi-submersible barge is key to the success of this operation and, in this instance, there were a limited number of suitable candidates which could perform the works. The solution that was settled on was to take an existing semi-submersible barge and add capability to allow it to carry out the load-out and float-off operations.

This article will enumerate some of the key characteristics of semi-submersible barges and investigate how they are used to accommodate float-on and float-off operations.

What is a semi-submersible barge?

Semi-submersible barges are those that are able to submerge, allowing their main deck to sink below the waterline; this capability subsequently permits anything sitting on the deck to become partially immersed, gain buoyancy and ultimately float clear. Once floating, the item can then be towed clear of the barge and the barge may resurface. The opposite can also be carried out whereby an empty barge deck is submerged and subsequently items can be towed over the deck. Once the item is in the correct position the barge resurfaces with the item loaded. To summarise, semi-submersible barges allow the float-on and float-off of cargoes. A notable example would be the *Boka Vanguard*, which is the largest semi-submersible vessel in operation, with a length of 275m.

What are the benefits?

Semi-submersible vessels may be used to efficiently instate and remove items weighing tens of thousands of tonnes to and from the water.

These vessels can be used for launching ships, drydocking

vessels, and even relocating large floating oil and gas semi-submersible platforms, often reducing risk by negating the need for a wet tow. They also allow for the launching of floating vessels and structures that may not be suitable for dynamic launching due to inherent issues in their construction or a lack of civil infrastructure, such as slipways or drydocks.

How does it work?

There are several main features which are consistent with all semi-submersible barges, enabling them to float items on and off their deck. These include:

- large, flat deck
- large internal ballast tanks
- ballast system
- flotation towers protruding high above the deck level

As noted above, similar to conventional cargo barges, semi-submersible barges also have a large, flat deck which allows the loading of extremely heavy cargos. Due to the nature of the cargo these vessels carry, their decks tend to be much stronger than other typical cargo carrying vessels. It is also common for a barge's deck to have a supporting grillage system installed which is used to support the item being loaded and distribute the load into the barge's primary structure.

The barge will also have large ballast tanks that enable it to lower in the water, or effectively 'sink'. When submerging, the tanks will be sequentially filled with water (normally by an internal ballasting system) and as the deadweight of the barge increases, so too does its draught. The ballasting sequence must be carefully planned out and engineered to ensure that stability and structural integrity is maintained throughout the process, especially at critical stages where there are large changes in waterplane area or positions of the centre of buoyancy. If this operation is not properly engineered, then the consequences could be disastrous. Once the required depth has been achieved and the item is either floated on or off as appropriate, the tanks can be de-ballasted until the barge has resurfaced.

The ballast system will normally make use of some internal ballast pumps and an array of pipework which connects the pumps to the tanks. An alternative would be to use an external system of submersible pumps, which will do the same task. However, these require set-up time prior to the operation and must be installed in a manner that is compatible with the semi-submerging operation. Either system allows water to be pumped from outside the barge into the tanks during submergence and from the tanks to outside the barge during resurfacing. Barge ballast pumps can range from several hundred m^3 of water per hour to thousands and these will be sized based on the ballast tank capacity of the barge. Large barges may be able to facilitate over 100,000m^3 of ballast water and therefore could take days to fully ballast without appropriately sized pumps.

The towers often seen protruding from the deck of the barge may serve a number of functions, however the main role is to provide stability when the deck is submerged. These towers may be located anywhere on the barge but will generally be seen at the forward end or on all four corners. The optimum location of these towers may not be the same for all loading and unloading tasks and will depend on the cargo,

location and type of operation. As a result of this, some semi-submersible barges have very large towers to allow for a greater degree of flexibility in orientation across a wide range of applications. It is also worth noting that the control room for operating the ballast system will generally be housed at the top of one of the towers, ensuring that operators are above the waterline and have a view of the operations taking place. Consequently, this tower will be fixed in position on the barge to accommodate the services and control systems connected to the ballasting system, which itself is often below the waterline. It is beneficial that the barge towers that are not housing equipment are not permanently fixed to the barge deck. This allows them to be relocated to the most suitable location dependant on the type of operation involved, resulting in a much more flexible semi-submersible barge.

Case study

In some cases, when the perfect vessel for an upcoming operation does not exist, building a new asset for a handful of operations would be an uneconomical option. In these circumstances, converting and upgrading an existing asset will often produce a more practical and timely solution. This was the case when Malin Abram were looking for a suitable barge to execute the load-out, float-off (LO-FO) operations for Type 26 (T26) frigates, for which it was awarded the contract last year. The combination of load-out quay dimensions, river bathymetry, tide restrictions and payload properties drove a launch solution that could only be satisfied by a very small number of semi-submersible barges and there was no guarantee that these vessels would be made available when needed. As such, the decision was made to procure and modify an existing semi-submersible barge that could then provide the necessary capabilities and guarantee availability.

The challenge was not a straightforward one. As mentioned above, semi-submersible barges, although at first glance appear to be simple, are a highly optimised compromise of structure that can accommodate a large range of deck loads through a range of seagoing, floating, and submerged conditions, and systems that will allow safe and efficient ballasting and de-ballasting of barge through a wide range of stability conditions. The target barge, *AMT Commander*, satisfied many of the technical requirements of the LO-FO operation, but still required to be lengthened,

THE FIRST TYPE 26 FRIGATE, HMS *GLASGOW*, IS SCHEDULED FOR DELIVERY LATER THIS YEAR. SOURCE: BAE SYSTEMS

HMS *GLASGOW*'S FORWARD BLOCK AREA

strengthened and have the maximum submerged depth increased to satisfy the float-off criteria.

From a structural perspective, the lengthening had to consider the increased hydrostatic pressure driven by the deeper submersion, along with the change to Rule Length that influences many of the structural properties of the hull. The position of the new hull section, which in this case was selected at the aft end of the parallel mid-body in order to reduce the impact on the ballast and vent systems, had an impact on the longitudinal position of midships and the subsequent location of the related strength boundaries (0.4L, 0.6L and collision bulkhead).

With the goal of significantly increasing barge capability and at the same time minimising the commercial impact of the conversion, the team had to optimise the structure to cope with both the local loads, predominantly affecting the shell and deck plate thickness and the strength of the transverse bulkheads, and the global loads, driven by the increase in ship length and predominantly affecting the internal longitudinal structure. Additional steel weight not only comes at a cost, but also impacts the buoyancy of the barge, which in turn has a major influence on stability and all floating and submerged conditions. These calculations had to be run in parallel with the ongoing development of the operational model, ensuring that the ballasting systems remained capable of ballasting and de-ballasting in line with programme requirements – all in all a highly complex interaction of competing priorities to establish a workable, safe and a cost-effective platform.

Additionally, a set of buoyancy caissons had to be developed as part of the project, which are to be strategically placed around the vessel deck to ensure that barge stability is maintained at every stage of the LO-FO operations. The engineers at Malin Abram were challenged with designing these caissons to include a series of handling innovations that will allow them to be easily moved around the deck without a large floating crane and facilitate fast and affordable reconfiguration of the barge between operations. This will enable the barge to carry out a wide range of additional tasks and add a floating drydock capability, ensuring a productive life for the semi-submersible barge after the T26 project has been completed. ■

RO-RO

WALLENIUS SOL UPS ITS GAME

By **Kari Reinikainen**, Correspondent

Wallenius SOL, the Swedish shipping company that was formed in early 2019, is building up to four LNG powered vessels at the CIMC Raffles shipyard in China that will be the largest ro-ro ships using this fuel.

Two ships have been ordered so far with an option for a further two. The first ship is due to be delivered in August, with the second vessel expected before the end of this year. Both vessels will be used on the company's service between ports in the Gulf of Bothnia and continental Europe, the requirements of which have significantly affected their design.

The Wallenius SOL newbuildings differ markedly from other recent ro-ro ships due to their high deadweight tonnage, explains Christian Damsgaard, head of naval architecture at Knud E. Hansen, the Danish company that was in charge of the design of the vessels.

In terms of hull dimensions, the Wallenius SOL newbuildings will have a length of 241.7m and a beam of 35.2m, thus being in the same league as the GG5G ro-ros that Grimaldi group is building for its own brand and Finnlines, its Helsinki based subsidiary. These ships are 238.0m in length and have a 34.0m beam. However, while the Grimaldi ships only have a deadweight tonnage of 17,000, the figure for Wallenius SOL's vessels is about 27,000.

"These ships have been designed to carry very heavy loads, such as export loads of paper, which is very heavy. This again has had a number of implications for other aspects of their design," Damsgaard tells *The Naval Architect*.

A key consequence is that the light displacement of the ships should be reduced as much as is viable. Pillars were used inside the vessel to support the four cargo decks, which is not the preferred solution when handling paper. However, in the case of these ships it became a necessary one.

The ships will carry mainly paper on the southbound leg of their voyage, whereas northbound the cargoes will be much lighter. This means that the hydrodynamics of the hulls had to optimised for two levels of draught, with about two metres difference between them (the summer load line will be 8.70m). This has led to optimisation of the propulsion train at varying loads.

They will be built to Finnish/Swedish ice class 1A Super which, together with a high displacement, low added resistance in waves, varying draughts and low delivered power, creates quite challenging requirements for the hull lines. The result is a hull with an 'ice-friendly' twin skeg and bulbous bow, all of which was heavily optimised by the use of CFD before it was tested at the towing tank.

THE FIRST OF THE WALLENIUS SOL NEWBUILDINGS IS SCHEDULED FOR DELIVERY IN AUGUST

The vessels will be fitted with two WinGD 7RT-Flex50DF main engines, each developing 10,080kW and giving them a top speed of 20knots, while their cruising speed will be 16knots. LNG will be stored in two tanks with a capacity of 685m^3 each.

Using LNG as fuel will result in a significant drop in emissions – Wallenius SOL puts the figure for greenhouse gases at 63%, that for NOx is at 96% plus the ones for SOx and particulates both at 99% when compared with the 2006 built *Tundraland*, its newest ship to date.

The new ships will be significantly larger than *Tundraland* and its two sister vessels that were built in Finland, at what is now Rauma Marine Constructions, in 2006-2007. They have a deadweight tonnage of 15,960 and a length of 190.80m, plus a beam of 26.44m. Lane metre capacity is 2,744 – roughly half of the figure of the newbuildings.

Wallenius SOL is using two of the three Tundraland class vessels on a service that links the ports of Oulu, Kemi, Kokkola and Pietarsaari in Finland with Lubeck, from where the ships proceed to Antwerp and Tilbury before heading north again, with calls at Zeebrugge, Vaasa and Kokkola before repeating the cycle from Oulu.

The rotation takes two weeks to complete and allows the use of these fairly large ships to serve ports that on a stand alone basis might not justify being included in such a service that has a weekly frequency. Vaasa was added to the rotation in November 2019 to serve e.g. the Wärtsilä diesel engine factory in the city.

Wallenius SOL also operates two other services. One links Oulu and Kemi in Finland plus Husum in Sweden with Lubeck and the other links Kemi, Oulu, Husum with Zeebrugge, Antwerp and Vaasa. All the Finnish and Swedish ports the company serves are on the Gulf of Bothnia. ■

LOOKING FOR SAFER CAR CARRIERS

By **Jan Babicz**, Baobab Naval Consultancy
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FIG. 1. IMAGINE THIS SHIP WITH LARGE HEEL TO STARBOARD AND TRY TO REACH THE FREE-FALL LIFEBOAT. THE INCLINING TEST COULD BE A GOOD OPPORTUNITY TO CHECK SUCH POSSIBILITY.
SOURCE: PIET SINKE (WWW.MAASMONDMARITIME.COM)

A new ship can look great, but without reliable data it is impossible to judge how efficient and safe it really is. Usually only the main characteristics are published and detailed General Arrangements are seldom available. Even RINA's own *Significant Ships* publishes plans which are, in many cases, just draft sketches of limited value for serious analysis. Working on my recent book *Ships and Their Equipment* I studied layout of various ships types; vehicles carriers being one of them. But I was surprised to discover some serious weak points.

Damage stability of pure car truck carriers: On the 5 December 2012, the car carrier *Baltic Ace* sank within 15 minutes of a collision with the 630TEU container vessel *Corvus J*. During the incident, *Baltic Ace*'s thin double skin was breached and water flooded the main deck. The increasing angle of inclination resulting from the continued ingress of water prevented launching of the lifeboat before the vessel capsized. Only 13 persons were rescued of the 24 crew. Having this in mind, it is difficult to understand how ships without double skin are able to meet the requirements of damage stability. In the event of a shell plating breach such ships will sink very quickly, giving no opportunity for an organised evacuation.

Another major problem is the very low levels of fire safety. Often with such vessels a long accommodation block is located over the car decks and is highly vulnerable should a cargo fire occur below.

Lifeboats and rescue boats: Vehicle carriers are provided with lifesaving equipment, but the location of the lifeboats does not always follow the rules. Many car carriers are equipped with a free-fall lifeboat located far away from the crew accommodations, contrary to the explicit requirements of SOLAS. For example, on the ABS-classed car carrier *Siem Confucius* there is a 126m distance between exit from the accommodation deckhouse and the free-fall lifeboat at the stern.

Generally, ships equipped with the free-fall lifeboats have a rescue boat. However, in the example on Fig. 2 it is located 26m above the waterline. Ships with conventional lifeboats have have no dedicated rescue boat at all (Fig. 3). Instead of a rescue boat, one lifeboat is equipped for rescue operations. Both solutions meet actual rules requirements yet neither has any practical value.

Controlled access to the ship: For safety reasons the access to the ship while in port is strictly controlled. In order to prevent unauthorised access to the ship the number of doors leading to the accommodation and machinery spaces is kept to as few as possible. When in port, access to accommodation and machinery spaces is possible only through one entrance leading to a Reception Area that is separated from the remaining part of the vessel. The Reception Area is supposed to consist of a Cargo Office, Ship Office and toilet. But on many car carriers these requirements are not observed.

One might expect that, at least on the starboard side, an enclosed staircase leading from the arrival area to the Ship Office in the accommodation deckhouse is arranged. Instead of this persons visiting the ship in port must enter an enclosed ro-ro space, cross the deck

FIG. 2. SOURCE: PIET SINKE

FIG. 3. SOURCE: PIET SINKE

between cars being loaded or unloaded to the other side, and look for stairs leading up.

Access to the Engine Room: SOLAS only defines requirements concerning emergency exists from machinery spaces. Some quite archaic requirements regarding access to the Engine Room from the living quarters can be found in the Load Line Convention.

But with or without rules, responsible designers should know to arrange a safe, enclosed passage from the accommodation to the Engine Room. This is particularly important for ro-ro vessels with accommodation fore and machinery spaces aft.

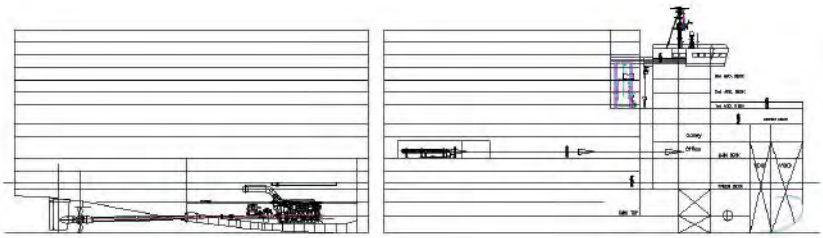
Solutions

In order to increase crew safety during a fire, the accommodation spaces should be totally separated from the cargo area. Instead of a long accommodation deckhouse located just over the car decks, a superstructure located fore shall be arranged (Dwg. 1). This is nothing new, just the standard solution for many ships.

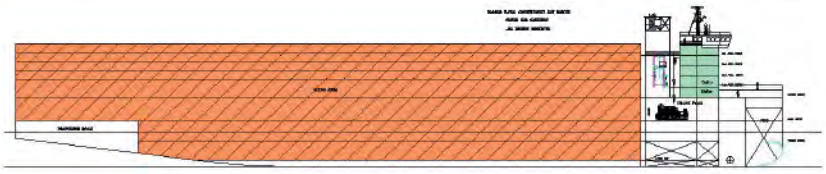
However, we can go one step further and move the Engine Room fore too. In this way the possibility of fire in the cargo area that has spread from the Engine Room will be eliminated. In addition, simple, direct access from the living quarters to machinery spaces will be arranged. Finally, the ship will be installed with diesel-electric propulsion and power plant arranged fore and protected by double sides.

With such a design, in the aft part it is necessary to arrange only a room for the electric motor driving a screw propeller. Access to the lower hold will be much simpler (Dwg. 2). Both versions have better damage stability due to two watertight zones fore, especially Version 2 with the Engine Room located fore. Unfortunately both also have one big disadvantage: reduced cargo capacity; compare Dwg. 2 with a standard arrangement (Dwg. 3).

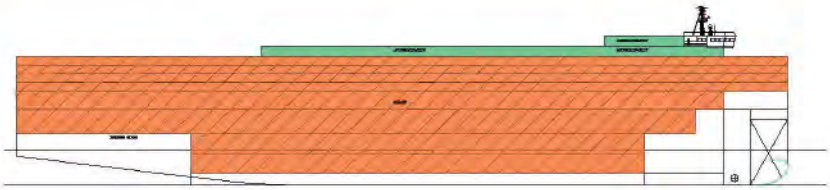
To solve this problem our ship must be wider and this can be arranged without increasing the breadth on the waterline, as shown in Dwg. 4. Cargo spaces on the new design are divided by two longitudinal watertight bulkheads. In the event of double side damage only the side hold will be flooded. However, the possibility of shell plating damage below the waterline from a collision with another vessel is greatly reduced with the new design. ■



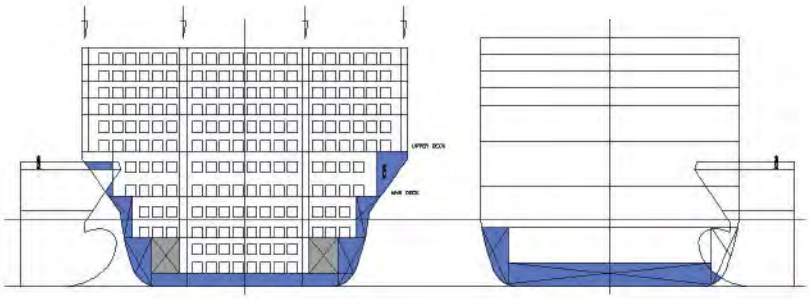
DWG 1. VERSION 1: SHIP WITH SUPERSTRUCTURE FORE, TWO FREE-FALL LIFEBOATS LOCATED ATHWARSHIP, ENGINE ROOM AFT. DESIGNED BY BNC JAN BABICZ



DWG 2. VERSION 2: SHIP WITH SUPERSTRUCTURE FORE, TWO FREE-FALL LIFEBOATS LOCATED AHTWARSHIP, ENGINE ROOM FORE. DESIGNED BY BNC JAN BABICZ



DWG 3. STANDARD ARRANGEMENT OF CAR CARRIER



DWG 4. NEW DESIGN ON THE LEFT AND STANDARD VERSION ON THE RIGHT. BOTH SHIPS HAVE SAME BREADTH ON THE WATERLINE. DESIGNED BY BNC JAN BABICZ

INTERIORS & ACCOMMODATION

A TURNING POINT FOR LASER SCANNING TECHNOLOGIES IN MARINE

By **Matthew Jensen**, managing director, Fraiserline

Fraiserline's business track record has overseen a number of successful refits, refurbishments and shiprepairs, both on varied scales and classification types. Our focus is mostly within passenger marine and cruise, so the delivery of innovative architectural environments has been dependant on improving an existing vessel; and, as we know, it is never "just a simple interior refit". The improvement to onboard interior and exterior environments also requires upgrades to the ship's infrastructure, services and regulatory classification requirements and can lead to drydocking the vessel for a significant duration to undertake such works. Most maritime project professionals are aware of the time limitations when drydocking a vessel, and the importance of good organisation, budgeting, management and planning is absolutely key.

In my experience, my fleet refurbishment begins with one common start point prior to any design related activities. Either before or after appointment, a series of ship visits are undertaken to understand the existing format of the vessel and to interpret the condition, briefing and diligence. These visits are usually paramount to the initial project stages to review feasibility, budget, and operational method. During this time, the project team may report on the existing state of the ship including photos and observations in line with any given brief from the client. After the design team is appointed, further onboard surveys are carried out, including measured surveys, condition reports, intrusive inspections, inventories and specialist investigations (marine).

On a larger ship, these processes can take weeks or even months at a time. This approach can be concerning in terms of efficiency, with some design teams having to return to the ship to obtain additional measurements or inspection related activities, resulting in further expense to the project with international travel and loss of saleable onboard accommodation if the ship is in operation.

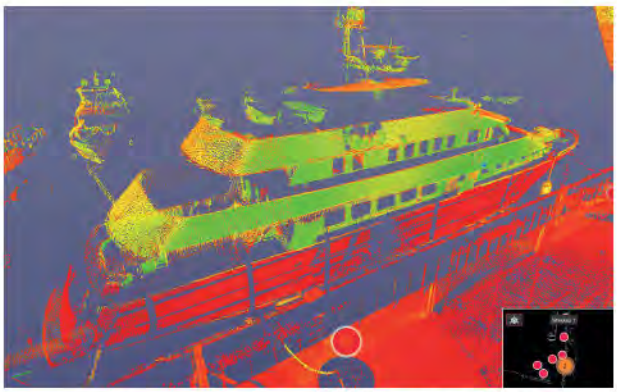
SCANNER ONBOARD THE HDS SCANNER CURRENTLY ONBOARD A VESSEL

Furthermore, the frequent issue of not obtaining ship drawings, product breakdowns, shipyard data or maintenance records from the owners or operators when undertaking refurbishment works has also been hugely risk adverse and expensive, only referencing a crude 'Fire Plan' or partial sheet set that ends up being superseded.

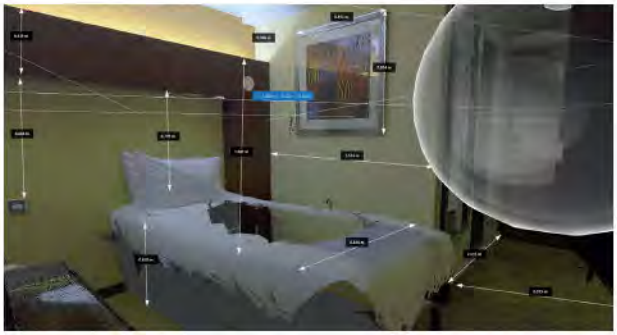
Digital capture

It had occurred to me that the construction industry is steadily embracing the influence of digital technologies to improve efficiency, productivity and quality. One of the major applications is the use of laser scanning or reality capture. Most fitting is the current impact of Covid-19 on shipyards and fleets, whereby stakeholders have been seeking reliable methods for remote inspection and monitoring. Keeping all this in mind, my efforts have been to introduce high definition surveying (HDS) laser scanning to improve the former practices with surveys and inspection procedures, and to refine the quality of the audit process. With our business now integral to laser scanning capabilities, the biggest challenge was regarding the constraints around marine environments. As a ship obviously moves, we had to ensure that laser scanning

VESSEL SECTION TAKING A SECTION THROUGH THE DATA SETS TO INTERPET LEVELS



YACHT EXTERIOR AND HULL AN EXAMPLE OF EXTERIOR OVERVIEW CONDITION SCANNING IN LOW-RESOLUTION



CRUISE HOTEL ROOM SCANNING USING POINT-CLOUD DATA FOR MEASUREMENTS AND DIMENSIONS

was practical and viable. On some smaller and older vessels, we noticed slight interference in areas with high vibration, such as engine casings, but on modern fleets this was less of an issue.

Our scanning approach is rather traditional with terrestrial systems; however, we do have the resource for more 'on-the-fly' sensors when it comes to complex or limited access environments. The system optimises the data onsite, but much like most digital capture technologies, post-delivery work is always required to check the data and correct any tolerance issues. The customer use cases have been extremely diverse across our network, and most have been relative to proposed modifications to ships or vessels.

However, laser scanning is also the beginning node to digitalisation of vessels. We have been hugely integral with offering digital-twin and building information modeling (BIM) capabilities for the maritime industry, and it is almost paramount that in order to get the full benefit of these platforms the existing context requires converting to digital, albeit using reality capture.

CRUISE SHIP CABINS AN OVERVIEW OF GUEST ENVIRONMENTS FOR AUDITS/INVENTORIES

ENGINE ROOM THE USE OF SCANNING TO INSPECT EQUIPMENT AND MEP

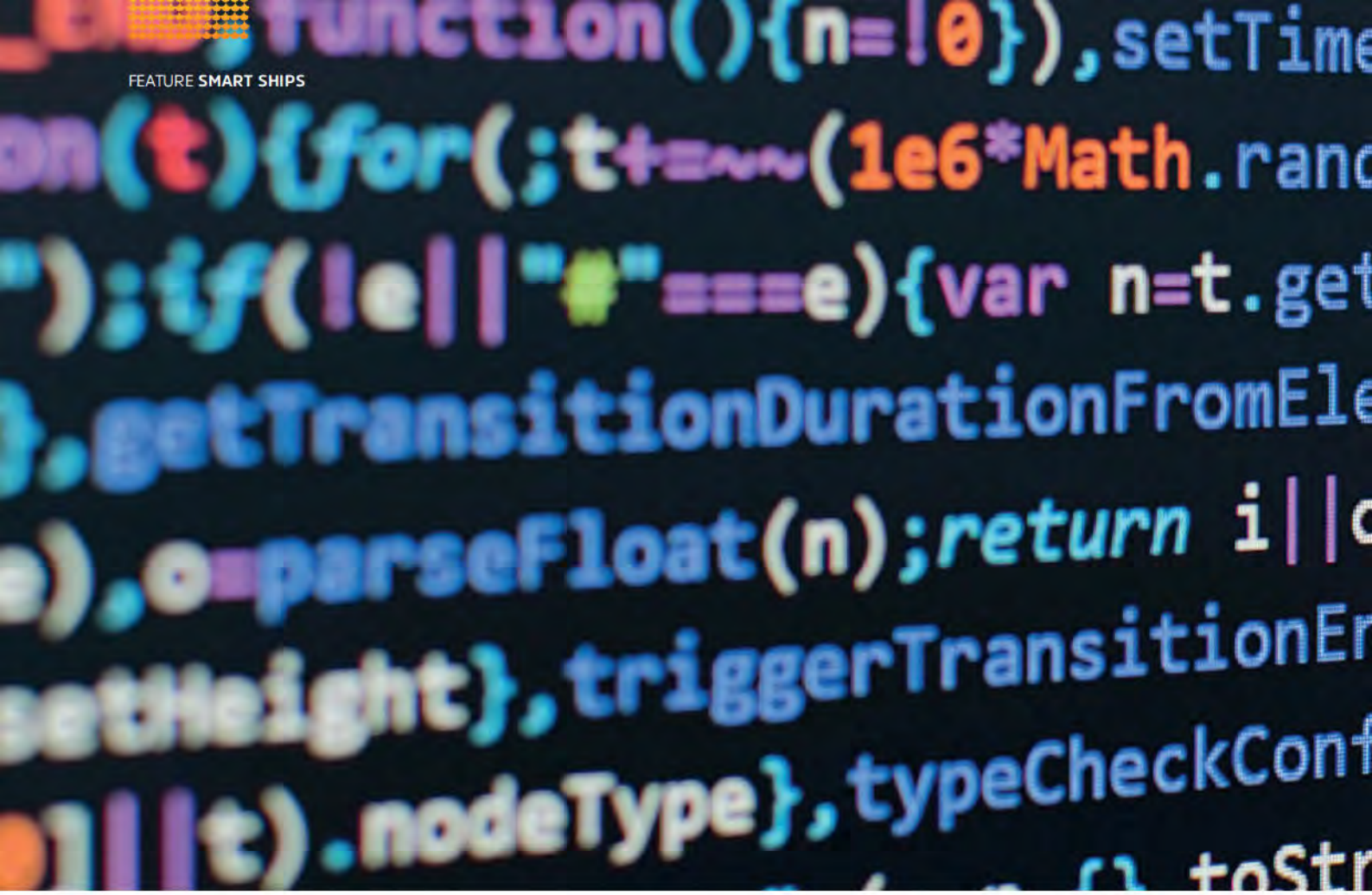
Audit trail

A scan can indicate defects onboard, identify the condition of the asset, provide an inventory of equipment onboard, and stand as an audit trail of the ship in its entirety. Scanning in this format also permits engineers to access areas on the ship that are confined or dangerous, which helps to limit risk. We have had some other interesting examples of very specific requirements. One company asked us to scan the scrubber and extract system on a large passenger ship in order to determine the best method for removal and the clearance allowances.

Another company wanted all cruise guest room cabins scanned so that the management team can forecast the refit schedule as well as contain an inventory of all equipment, furniture, fittings and interior types. Our most recent briefing has been to scan a large ship hull in drydock in order for the engineering team to closely inspect any structural defects or faults with the propulsion system. This will eventually form an audit trail of inspections over time, so that the engineers are able to overlay the various data sets and monitor the dilapidation of the hull periodically.

We have embraced this technology as being fully universal to requirements, both from technical engineering, owner, naval classification, maintenance and design standpoints. With the granularity of scan data becoming extremely high-definition, we are confident the technology will add value to the maritime refurbishment, design and engineering professions. Our other innovations are to combine this with GNSS positioning tools to help shipyards track progress on newbuild vessels. With other industry partners providing good VR and AI based systems, the digital influence on the maritime industry has never been so enticing. Now we have Maritime 4.0 on the horizon, our biggest ambition is to support the industry by converting the physical assets into digital assets for the benefit of the industry. ■

PILOT HOUSE AND BRIDGE SYSTEMS FORMING A DIGITAL-TWIN OF SENSITIVE ENVIRONMENTS



SOURCE: FAHRUL RAZI

SMART SHIPS

IMO MANDATE RAISES THE STAKES FOR CYBER PROTECTION

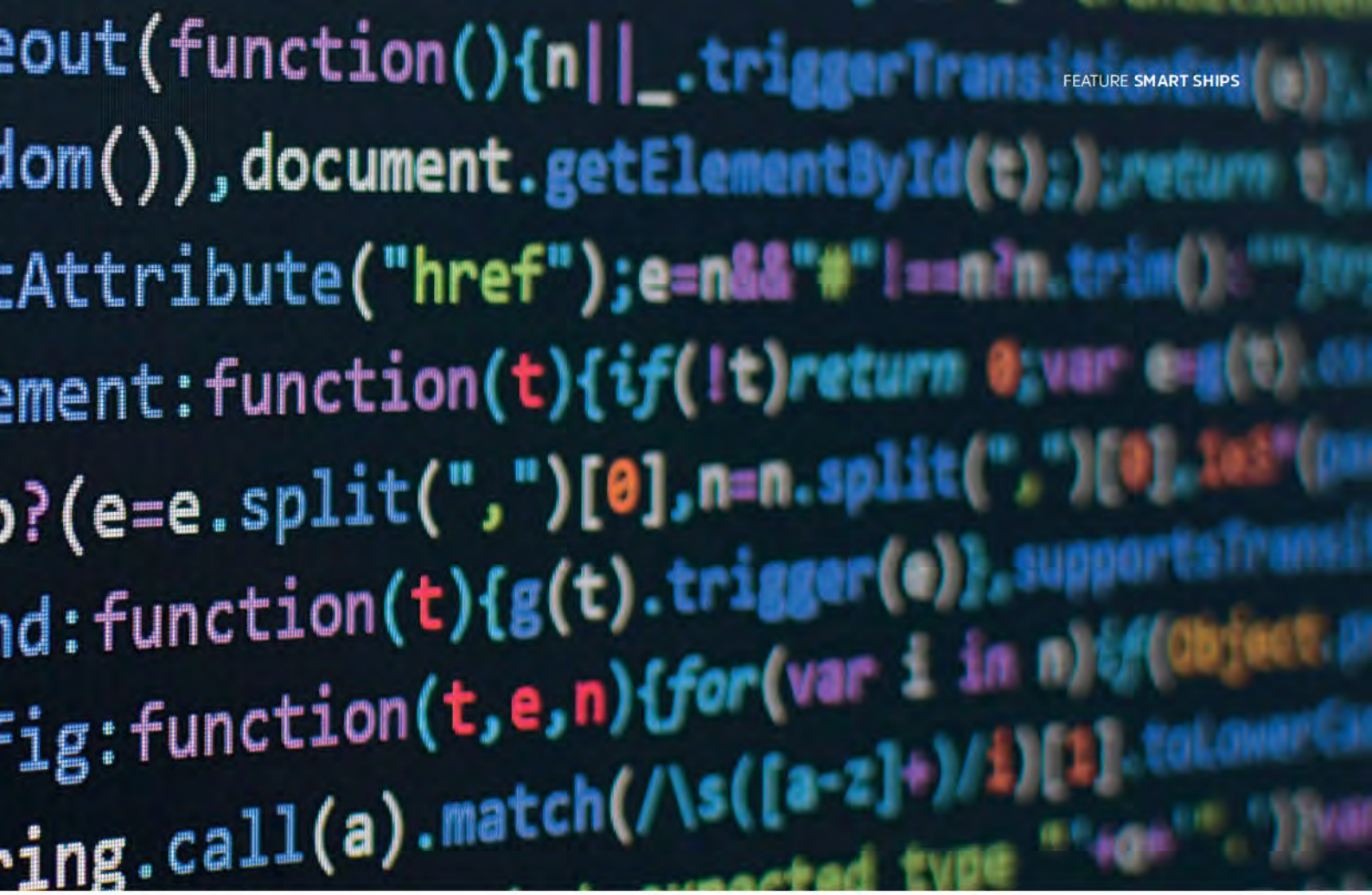
By **Richard Halfhide**

It was not so many years ago that cybersecurity was a novel problem that most shipowners could afford to treat if not lightly then with no more than moderate concern. But the new generation of smart ships presents a multitude of challenges that go far beyond that of the errant crew member unwittingly installing malware from a USB stick onto the bridge system. Moreover, it's a problem that's growing exponentially; one US-based consultancy estimated in 2020 that cyber attacks on the maritime industry's operational technology (OT) systems had increased by 900% in the previous three years.

Although at times it's hard not to suspect scaremongering, high profile cases such as the 2017 Maersk NotPetya incident, which cost the Danish operator an estimated US$300 million, show the potential consequences of not being forearmed. In September 2020, CMA CGM suffered a ransomware attack that compromised its network and prevented customers having access to its booking systems. A month later IMO itself was the victim of cyber problems. It was a timely reminder of the importance of new regulatory instruments, and effective from 1 January this year, IMO Resolution MSC.428(98) obliges shipowners and managers to assess cyber risk and implement appropriate procedures and countermeasures as part of a ship's safety management system.

"THERE WAS UNTIL RECENTLY, SOME COMPLACENCY WITHIN THE SECTOR THAT CYBER RISK WAS NOT AN ISSUE FOR SHIPOWNERS."

Andrew Hill, an executive director and cyber coverage specialist at insurance brokerage Willis Towers Watson (WTW), believes that shipowners are finally beginning to wake up to the dangers of lapse cybersecurity. He comments: "There was perhaps, until recently, some complacency within the sector that cyber risk was not an issue for shipowners. Highly publicised cyber-attacks against several of the largest shipowners in the world and an ongoing transition towards automated



operations have, however, dramatically altered the perception of cyber threats within the industry."

The ISM requirements in particular have galvanised shipowners' efforts to ensure they have their cyber affairs in order and, just as importantly, be capable of demonstrating that compliance if called upon to do so during a Port State Control inspection or any other auditing. Given that such expertise is often not available inhouse they are increasingly engaging third parties such as Tel Aviv-based security company Cydome, a team of maritime and cybersecurity professionals, who have joined forces with the aim of creating full spectrum protection for vessels, fleets and offshore facilities.

"Our clients' main concern nowadays is understanding what will be the impact on their organisation from the new IMO cybersecurity regulation," says Cydome's co-founder and COO, Avital Sincai. "Our offer includes cyber risk analysis, maturity assessment process and gap analysis and of course an end-to-end cybersecurity solution for real-time protection. The final report details high severity vulnerability for each vessel [with], critical asset and mitigation plan."

Having been thoroughly briefed on the risks and potential losses, some clients opt to have Cydome's own cybersecurity solution installed to monitor and protect their vessels. Sincai says that with the IMO mandate there has been increased demand for cyber solutions that embed automated tools into the ship operator's systems, so that they are better prepared for inspection and reporting. However, different clients have different needs and priorities. "For example, for companies providing services that are very much schedule focused, such as container shipping lines, any form of onboard attack can lead to delayed arrival of a vessel in the next port and the immediate disruption of global supply chains," she comments.

Different risks

Sincai thinks that the threat is more insidious than previous security risks, such as Somali piracy: "A piracy attack could only affect a single vessel. Whilst there will be financial losses, in terms of the vessel being unable to operate as normal, once the vessel has been successfully returned to the owners it can resume service. It is highly unusual for piracy attacks to fundamentally damage the vessel beyond repair. It seems that while piracy attacks lead to local finance loss, cyber attacks can affect it from a wider perspective, like the reputation of the company, damage their IT infrastructure, raising the insurance premium, and risking the safety of the crew."

In cybersecurity terms, a ship may be exposed to different threat scenarios than those associated with land-based assets. "The threat actors [on land] would be cyber criminals and hacktivists with a desired outcome to gain mostly financial benefit. With vessel hacking the threat actor could be a third party contractor doing remote maintenance to a vessel that can create financial loss and vessel-critical asset destruction (such as main engine damage). But it could also be nation states and terrorists with a desired outcome to affect the vessel, interrupt its sailing route, disrupt navigational capabilities or destroy main vessel systems."

The critical asset targeted might be the VSAT router, GPS, ECDIS, AIS, main engine systems, stability and ballast systems, cargo system or others. In short, the benefits of improved crew welfare, ship-shore communication and remote fleet management create new vulnerabilities for onboard systems. Cydome's analysis of recent incidents discovered that often ship operators are not aware that failing to protect critical onboard assets allows hackers to exploit well-known weaknesses to execute the attacks.

Sincai comments: "As part of the vulnerability scanning performed by Cydome's automated solution installed onboard vessel for its protection, we found that many of the vulnerabilities are from unpatched versions of software and hardware, poor connectivity hardening, but mainly due to the lack of visibility over IT & OT assets onboard.

"There also exists a level of complacency that ships out at sea are not as vulnerable to cyber attacks as a shore based facility. Most shipping companies have been the victims of cyber attacks on their shore-based systems in the past few years, and this is increasing at an alarming rate. A lot of focus has been placed on improving cybersecurity to critical business systems, but this has not been the case with the ships."

Ransomware

Mike Yarwood, managing director of TT Club's Loss Prevention department, tells *The Naval Architect* that cyber criminals are becoming increasingly more nuanced in their modus operandi. Yarwood comments: "Ransomware attacks are more targeted than previously, they are no longer the 'shotgun' approach of seeing who falls. They are now tailored to the target in terms of the demand made.

"THERE IS A DEFINITE CONCERN FROM THE P&I CLUBS WHEN IT COMES TO CYBER THREATS"

"Historically there may have been a simple request for US$500.00 in Bitcoin to release access to systems. Today, the demand is tailored to the turnover of the company. There has also been a change of direction insofar that a ransomware attack used to involve a simple denial of service. Now the attacker might also raise the stakes by throwing in a threat to not only deny access, but to share sensitive data on the dark web."

WTW's Hill concurs: "Ransomware has emerged over the last 12 months as arguably the single biggest cyber threat. The ransom demand itself is invariably not the great source of loss, rather it is the disruption to the business operations due to the encryption of files that are being held 'hostage' that can have a devastating financial impact on the organisation."

Hill notes that another area of concern is the trend towards hackers exploiting software that is widely used by organisations around the world. "The SolarWinds hack is a notable recent example of such an event. This threat poses an enormous challenge to those within the organisation who have responsibility for maintaining its cyber security integrity. You might be satisfied that your business has robust cyber security in place, but how can you be certain that those responsible for the security of the software upon which your business relies can say the same?"

Risk protection

There have been accusations that the insurance industry has lagged behind when it comes to offering shipping adequate cyber risk protection. Sincai thinks that while for the moment shipowners are more concerned with adhering to regulations and ensuring they are better secured against cyber threats, there is likely to be increased demand in the coming years. She notes: "There is a definite concern from the P&I Clubs when it comes to cyber threats and the general view seems to be that shipping lines are far behind when it comes to complying."

Last year, WTW launched CyNav, a customised cyber insurance policy for the marine industry and recipient of Insurance Insider's 'Cyber Broking Innovation of the Year' award. Hill explains that CyNav, which is currently available for shipowners only, was created in response to clients' concerns that 'off the shelf' cyber policies did not adequately address the cyber exposures specific to their operations. A cross-section of expertise including cyber coverage specialists, experienced mariners and cybersecurity experts, all based within WTW, were involved in the product's development.

Specifically, the ISM Code was one of the driving factors behind it: "We have seen with other areas of cyber risk, most notably data protection, that the introduction of stringent legislation and regulatory frameworks do bring the applicable cyber risk into greater focus. For many of the shipowners who approach us, it is clear that these changes to ISM Code have brought the issue of cyber risk to board level," says Hill.

Surprisingly perhaps, no cyber assessment survey is required by any of the insurers who currently support CyNav. Instead, shipowners must complete a proposal form designed to help the underwriter determine the organisation's cyber security posture. "WTW utilises its inhouse cyber security specialists to work with clients on the proposal form which allows for accurate presentation of the organisation's cybersecurity to the underwriter.

"This approach typically streamlines what can otherwise be a cumbersome process. At the same time if, in the WTW cyber security specialist's assessment, the client's cyber security posture will likely lead to unfavourable insurance terms, recommendations can be made on what needs to be improved in order to ensure competitive terms can be obtained for the client," says Hill. Because CyNav is a broker form, drawn up by cyber insurance specialists from legal backgrounds, it has been drafted in such a way as to avoid being overly prescriptive unless necessary, an important consideration given that cyber is an ever-evolving threat. WTW's cyber specialists continually monitor the cyber policies it recommends to clients, including reviewing how they might be updated to reflect changing cyber exposures.

What's undeniable is that with today's connected ships cyber is an issue that's here to stay, and whether for ISM compliance or, more importantly, the security of their assets shipowners can no longer afford to ignore it. ■

ECOSPRAY OFFERS A SMARTER EXHAUST GAS SOLUTION

By **Richard Halfhide**

Although the use of onboard scrubbers for desulphurisation was perceived by some as a retrograde measure at the time IMO's 2020 global sulphur cap was being phased in, there is now a growing acceptance of exhaust gas technology as a cost efficient solution for those shipowners who remain sceptical about the merits of running their vessels on VLSFO or LNG. Their case has been helped in part by some major operators, such as Maersk, declaring their preference for scrubbers, at least until such a time that carbon-free fuels become a viable proposition.

Another significant proponent has been cruise operator Carnival Corp, notably through its membership of the multi-company lobby group Clean Shipping Alliance 2020. In 2017, Carnival acquired the Italian-based manufacturer Ecospray Technologies, a long-standing partner which has installed more than 600 exhaust gas cleaning systems (EGCS), the majority onboard vessels.

Stefano Di Santo, CEO of Ecospray, says the acquisition transformed the company. He comments: "Being part of Carnival Corporation has given us the opportunity to implement high-performance and reliable technological solutions in record time. We were enabled to gain experience across the entire fleet and unparalleled sailing experience, which has allowed us to build robust solutions and use case specific innovations at speed."

Alberto Di Cecio, director of Ecospray's marine department, tells *The Naval Architect*: "Maritime is our greatest business, but we also operate in the industrial world for gas cleaning, clean fuel production and green power generation. In the maritime market, Ecospray is not only a leader in the scrubber market but also provides technologies for gas and water cleaning and air sanitisation."

In February, Ecospray launched a new Integrated Internet of Things (IIoT) based desulphurisation solution, the Smart Scrubber. The product, which is being developed in partnership with German IoT specialists relayr, is said to offer shipowners advanced remote AI-enabled control of the scrubber and advanced lifecycle analysis, combined with Ecospray's "best on class" performance. As well as optimising the scrubber's performance, and thereby extending the equipment's life expectancy, the Smart Scrubber will benefit from remote monitoring while guaranteeing compliance with emissions requirements.

The first three implementations of the Smart Scrubber – onboard a cruise ship, cargo vessel and ro-ro – will enter operation from the end of June and allow the AI to begin the machine learning process. While there the market trend is towards smarter scrubber solutions with condition-based monitoring, Ecospray's solution

SOURCE: ECOSPRAY

takes that a step further. Di Cecio comments: "So far we didn't observe any similar full AI managed solution, where key parameters and decisions are supported by relayr's algorithm."

Relayr is a newcomer to the maritime sector and still perhaps most widely known for the Wunderbar, a novel IoT starter kit for app developers that resembled a chunky chocolate bar, which helped launch the company back in 2014. Since then, it has continued to expand its end-to-end IoT solutions for a variety of industries. Ecospray's Di Santo had previously collaborated with relayr and saw interesting opportunities in a partnership focused on the scrubber market.

"Ecospray gave us the chance to explore this vertical sector that has many similarities with others where we came from," says Francesco Cattaneo, a senior account executive for relayr, adding that each of the company's solutions are tailor-made to the partner's needs, but all of them are starting from relayr's well-developed know-how and experience in the industrial market.

Challenged by *The Naval Architect* to explain what an IIoT control system for scrubbers offers that a conventional 'unconnected' system doesn't, Cattaneo refers to the Equipment as a Service (EaaS) approach, whereby the Smart Scrubber will be leased to the shipowner for a usage fee rather than requiring an outright purchase. As well as offering a lower entry barrier and quick scalability of the system across a fleet, Ecospray plans to make the product available with IMO Warranty, a financial tool which will guarantee the shipowner's fuel savings should the device fail to perform. "IIoT is a part of this, together with insurance, financing and business planning. This is unique compared to any other proposal," says Cattaneo.

While it's too early to put an estimate on potential savings of the Smart Scrubber, Ecospray's Di Cecio is confident. "With the smart scrubber, we can anticipate extremely interesting economic figures, resulting in significant savings on the opex. Considering the scrubber as-a-service, the target is to drastically alleviate the capex burden for the shipowner." ■

TAKING PLACE THIS YEAR AS A REMOTE MEETING, MEPC 76 WILL LIKELY SEE THE ACCEPTANCE OF EEXI. SOURCE IMO

ENVIRONMENTAL LEGISLATION

ADDRESSING AND EXPLAINING EEXI SHIP POWER LIMITATIONS

Edwin Pang, MRINA, Chairman of the RINA IMO Committee, explains the draft guidance for using ship power limitations on existing ships to comply with EEXI requirements, in anticipation of the upcoming IMO ISWG-GHHG 8th meeting this month and the MEPC 76 meeting in June

By **Sophie Collingwood**

The Energy Efficiency Existing Ship Index (EEXI), a technical certification measure due to be accepted by IMO at MEPC 76 in June, will come into force no later than 1 January 2023. Based on the Energy Efficiency Design Index (EEDI) framework for newbuild ships, EEXI will be introduced as an amendment to MARPOL Annex VI, and all existing ships defined within its remit will be required to comply within their first annual, intermediate or renewal survey. As Edwin Pang, MRINA, Chairman RINA IMO Committee, emphasises: "It is quite likely, particularly because of this timescale, that the effect of EEXI on existing ships will primarily be to drive a reduction in power rather than fitting of energy saving devices."

While compliance with EEDI was largely achieved by engine derating, larger diameter propellers, lower rpm and hullform optimisation, adherence to EEXI will mainly fall to ship power limitations. At a recent webinar held by the Nautical Institute (NI), in collaboration with the Royal Institution of Naval Architects (RINA), Pang drew attention to draft guidelines for implementing EEXI, which have been developed by an IMO correspondence group. The guidance, which will be further discussed at the 8th IMO Intersessional Working Group on Reduction of GHG Emissions from Ships (ISWG-GHHG) meeting in May and MEPC 76 in June, foresees two main types of ship power limits: shaft power limitation (ShaPoLI) and engine power limitation (EPL).

A limited EEXI calculation

Ship power limitations are proposed as they can facilitate a reduction of power within the existing method for calculating EEDI/EEXI. The key parameters used to calculate EEDI/EEXI, such as the engine power at 75%MCR (P_{me}), are determined by a vessel engine's maximum output, known as the maximum continuous rating (MCR). As Pang explains: "Conceptually, the approach is to reduce MCR, because P_{me} is fixed at 75% MCR, and it is suggested that the way we would want to do this is via a shaft or an engine power limit."

A ShaPoLi or EPL will restrict the ship's MCR a percentage below its original output, dependent upon the needs of the individual vessel to meet its required EEXI. "Early investigations indicate that a wide range of limits will be applied. I have seen limits from a handful of percent all the way up to about 40% or more, and it tends to be that the older ships that will apply the more drastic limitations," Pang observes.

The ship's new $P_{me,limited}$, the EEXI calculation point, will be 75% of its limited MCR (MCR_{lim}). Once in place, the ship can operate up to its MCR_{lim}, above which is the ship's power reserve (see Fig 2).

Limiting and unlimiting power

According to the draft IMO guidelines, ShaPoLi will require a control unit for calculating and limiting the power transmitted by the shaft to the ship's propellers, as well as sensors for measuring torque and rotational speed and a data recording and processing device. However, Pang adds that ShaPoLi will be suitable for specific types of vessel: "If you have a typical ferry concept, where you have two engines into a gear box and then into a shaft, it might make more sense to limit power in the shaft. Otherwise it's with the engine."

Whereas for EPL, more modern engines have electronic control and the means of limiting such equipment (or accessing the power reserve) is via a fuel index limiter linked to a password, which can electronically lock the fuel index or directly limit power in the engine's control system. On the other hand, a mechanically controlled engine will be restricted with a sealing device that can physically lock the fuel index, using a mechanical stop screw sealed by wire or an equivalent device with a governor limit setting. Both mechanical and electronic EPLs should be set up

$$\frac{\left(\prod_{j=1}^{n} fj\right)\left(\sum_{i=1}^{nME} P_{ME(i)} \cdot C_{FME(i)} \cdot SFC_{ME(i)}\right)+\left(P_{AE} \cdot C_{FAE} \cdot SFC_{AE}*\right)+\left(\left(\prod_{j=1}^{n} fi \cdot \sum_{i=1}^{nPTI} P_{PTI(i)}-\sum_{i=1}^{neff} f_{eff(i)} \cdot P_{AEeff(i)}\right) C_{FAE} \cdot SFC_{AE}\right)-\left(\sum_{i=1}^{neff} f_{eff(i)} \cdot P_{eff(i)} \cdot C_{FME} \cdot SFC_{ME}**\right)}{fi \cdot f_c \cdot fi \cdot Capacity \cdot f_w \cdot V_{ref} \cdot f_m}$$

FIG 1: A SIMPLIFIED CALCULATION FOR EEXI/EEDI, INCLUDING (P_{ME}) FIXED AT 75% MCR

More simply:

$$\frac{(75\%\ MCR \times Carbon\ Factor \times SFOCME) + (\sim 5\% MCR \times Carbon\ Factor \times SFOCAE)}{Deadweight \times Speed\ @75\%\ MCR}$$

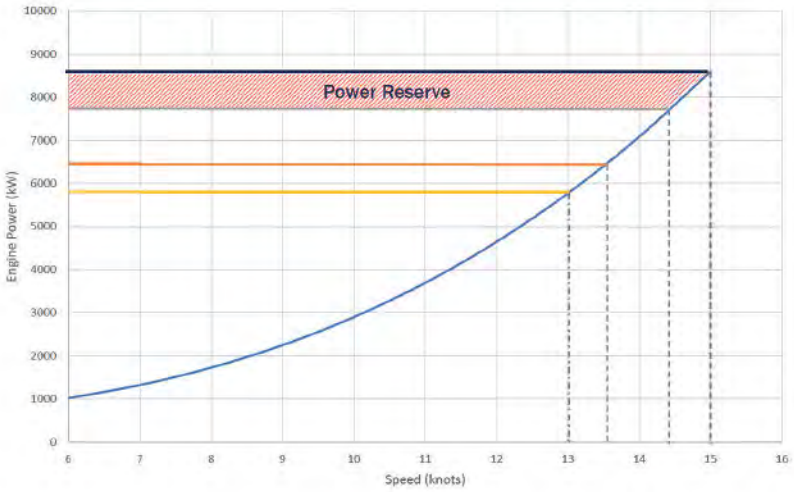


FIG 2: A GRAPH DISPLAYING AN EXAMPLE IMPLEMENTATION OF A 10% POWER LIMITATION ON A VESSEL WITH 100% MCR AT 8,600KW

so that the ship's crew cannot release the EPL without permission from the ship's master or Officer in Charge of a Navigational Watch (OICNW).

The proposed guidance for EEXI also outlines a range of reporting and general system requirements for ShaPoLi and EPL, as well as an onboard management manual (OMM) used for the purpose of logging, among other functions. "There are obviously reporting requirements and some general system requirements for what your system should be able to do and there is, being mooted, the concept of an onboard management manual for this – because it is important that the crew onboard are very familiar with how this works in the case it needs to be released," Pang adds.

Accessing the reserve power

Although a shaft or engine power limit will make part of a vessel's power range unavailable, a crucial part of the ShaPoLi or EPL actioned for EEXI is that it can be overridden. This allows the ship and its crew to access a vessel's power reserve for the purpose of securing the safety of a ship and saving life at sea. This is different to engine derating, which is permanent and affects engine output characteristics such as SFOC and torque.

The draft guidelines put forward by the IMO correspondence group addresses access to the ship's reserve power, but Pang notes that a more detailed exploration needs to be undertaken in the event that this power is not used: "The guidelines mostly are along the lines of if you unlimit power and then you use it. For electronically controlled engines, and if its an EPL, then it's all been software driven so it's very easy to reset it even if you don't use it – you could log it in some way."

"For the mechanical EPL, where there is a physical seal, it is less clear cut. If you unlimit or remove the seal as a precautionary measure, just in case, and then you have to put it back even though you've never used the power. How that will be treated probably needs some clarity."

In response to this issue, RINA and NI have recommended an amendment to the proposed guidelines; an insert addressing the precautionary use of power limit override reads as follows:

"Where an EPL/ShaPoLi override is activated but the power reserve is not subsequently used, this event should be recorded in the bridge and engine room logbooks. The engine-room logbook should record power used during the period when the override was activated. The EPL/ShaPoLi should be reset as soon as possible, and details of the reset should also be recorded in the bridge and engine-room logbooks."

Recommendations from NI/RINA

Several areas of concern in light of the draft guidelines were raised during the webinar held in March. Captain Robert McCabe, FNI, Chairman of the NI IMO Committee, for example, highlighted that: "The implications may be that, in the next port, if you have activated the override, how you have reset it. That's fine in some ports, but in others you may not be able to get a representative of your Administration or your recognised organisation (RO) to witness that, and we want to make sure that those issues are understood."

As it stands, the draft guidelines propose that after releasing a ship power limit, the reactivation or replacement of the ShaPoLI/EPL should be confirmed with supporting evidence by the Administration or the RO at the earliest opportunity. Confirming a system reset is a topic subsequently mentioned for discussion in a NI/RINA document, where it is noted: "Consideration should be given to alternative means of confirming system resets pending Administration/RO inspection."

Further to this, Pang adds: "Most class societies are increasingly relying on remote surveys with the assistance of the crew and we could potentially expect something to be developed for this – but it's perhaps worth getting in some comment from a class society."

Including the above mentioned topics, NI and RINA have proposed four amendments to the draft guidelines for ShaPoLi and EPL set out by the IMO correspondence group, as well as identifying 11 key areas of concern. These are all covered in a document that NI and RINA have jointly submitted for consideration by the IMO Committee, with a view to inform the discussions at MEPC 76 and allow for further fine tuning of the guidance if required. ■

BALLAST COMMISSIONING CAUSING CONFUSION FOR SHIPOWNERS

By **Richard Halfhide**

Although they may have been granted a two-year reprieve between 2017 and 2019, and the further concession that they need not have a system installed until the vessel's next International Oil Pollution Prevention (IOPP) renewal survey, the reality of the Ballast Water Management Convention (BWM Convention) is starting to bite for shipowners. It's anticipated that demand for ballast water management system (BWMS) installations will peak next year, but with depressing predictability there remains confusion about the different regulations and testing requirements for commissioned systems after they've been installed onboard a ship.

Marcie Merksamer, VP at environmental services and consulting company EnviroManagement, says that BWMS commissioning testing is the subject that currently generates more questions from the company than any other. "There's different sources of information, such as flag state, port state, classification societies and service providers. Sometimes even within those groups the requirements aren't necessarily aligned."

One of the prevailing misconceptions is that the US Environmental Protection Agency's (EPA) Vessel General Permit (VGP) and IMO's D-2 testing standards for ballast systems are equivalent, but Merksamer emphasises that they are quite different. She explains: "The EPA VGP has annual monitoring and recording requirements, whereby a vessel has different things to do throughout the year. There are 27 different vessel discharges that are regulated, including monthly BWMS functional monitoring.

"IMO's commissioning testing is a one-time biological testing requirement (assuming that D2 requirements are met first time). This testing is to confirm the BWMS is functioning according to the manufacturer's specifications at installation. To gain type approval the systems go through a rigorous amount of testing on all aspects of their treatment system, however, equally important to its ability to meet the discharge standard is how it's designed, engineered and installed."

There are also crucial differences in the way testing is done. "For VGP testing we can take a relatively small sample that can be collected at any point during ballast water discharge. The commissioning testing for D-2 requires a minimum sample of one cubic metre. It's a more involved process and needs plankton nets to separate out organism size classes, so very different skillsets are required."

According to the timeline formally approved at MEPC 75, sampling and analysis for commissioning testing should apply from 1 June 2022, but IMO is encouraging national administrations to implement the scheme as soon as possible. Some flags have already made it mandatory while for others it is presently only a recommendation, making it important the owners check with the flag administration what their requirements are. "As countries decide that they have an interest and have the infrastructure in place to begin implementing this and making it mandatory, we will continue to see changes," says Merksamer.

SOURCE: SHUTTERSTOCK

Equally important, as detailed in BWM.2/Circ. 70/Rev. 1, which was approved at MEPC 75, is ensuring that a qualified testing organisation is used, such as EnviroManagement itself. These organisations need to be knowledgeable not only about sampling but also shipboard procedures. The testing organisation also needs to have the approval of the flag administration, or the class society if it is acting on the flag's behalf.

"It's not uncommon for a vessel owner to want commissioning testing done tomorrow morning and assume a sampling team would be available... but those that are approved and qualified are more limited to schedule this in advance," says Merksamer.

Typically, commissioning testing is supposed to happen at the shipyard after the BWMS has been installed, once the manufacturer and class society have done their requisite checks and officially handed the system over to the crew. However, there are certain circumstances, such as when the local water isn't of the desired salinity, when it's necessary to conduct the test at another location.

Another critical consideration is crew familiarity. Although the BWMS manufacturer is allowed to be present during commissioning testing, the crew must be able to operate it without assistance to demonstrate they are ready to begin operating the system on a regular basis. ■

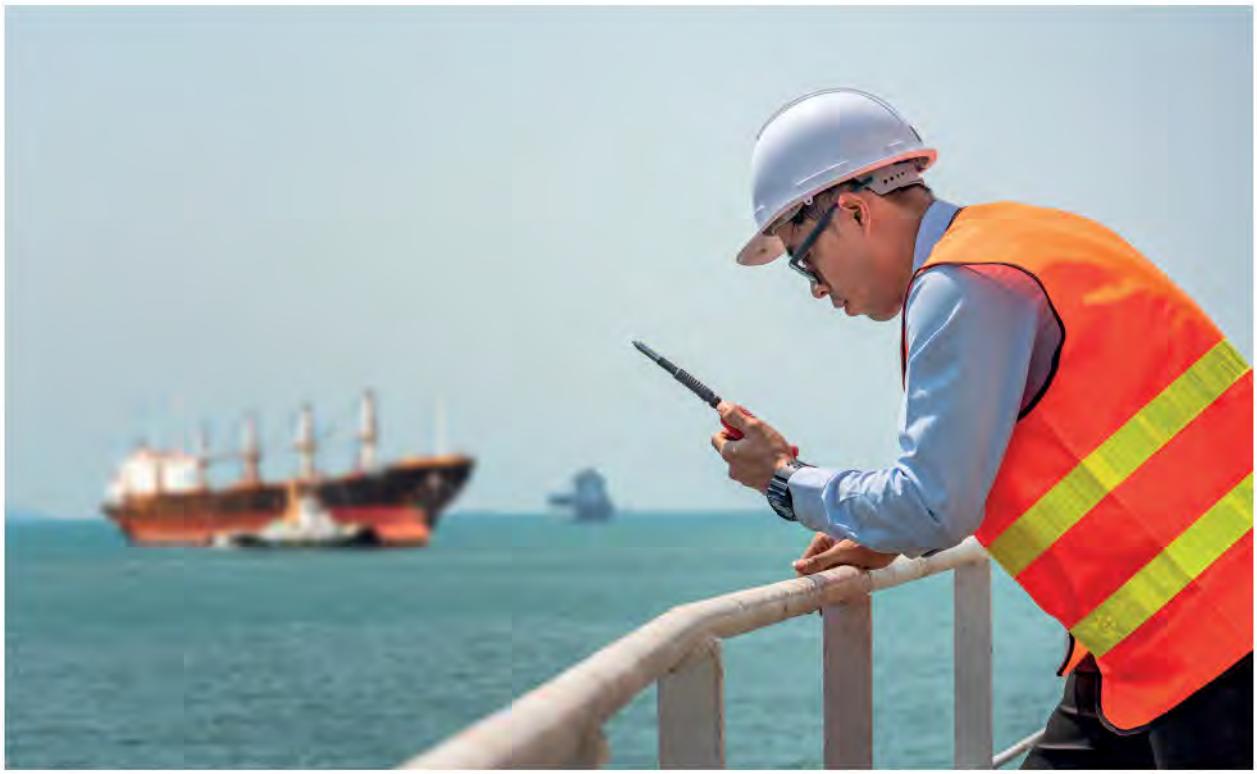
Further reading

The SOCP has published the Ballast Water Management Systems User Guide, developed in collaboration with the US Maritime Administration: https://www.socp.us/bwms.

The 'Ballast Water Commissioning Testing Industry Guidance to Support Practical Implementation,' can be found at https://bwema.org/resources.

PARIS MOU AND THE FIGHT AGAINST MARITIME POLLUTION

By **Miguel Ángel Gómez Ruiz,** Universidad Politécnica de Madrid (Spain), Ministerio de Fomento (Spain) and **Rodrigo Pérez Fernández,** Universidad Politécnica de Madrid (Spain)



SOURCE: SHUTTERSTOCK

The coastline of the European Union (EU) is 68,000km long and contains over 1,000 individual ports, encompassing 23 coastal states and 27 flag states. Between them they control 90% of foreign trade in the EU and around 40% of trade between EU countries. This involves managing 4 billion tonnes of cargo (Fig 1) and 414 million passengers that travel by ship each year. The number of vessels calling at the main EU ports in 2017 is estimated at over 2.1 million, an increase of 1.7% from the previous year. In the same period, the estimated gross tonnage (gt) of the vessels calling in EU ports grew by 3.3% to 17.8 billion gt. During the same period, the average size of vessels rose by 1.5% to almost 8,300gt in 2017 (Eurostat Database Maritime Transport 2017).

As the world's most important exporter and the second biggest importer, maritime shipping and related services to the EU are essential in helping European companies to compete globally. The EU's maritime sector directly employs more than 640,000 workers at sea and on land (ECSA, 2019) and a further 1.4 million workers indirectly. These maritime industry professionals retain a lot of knowledge, skills and unique heritage in Europe, which should be respected and preserved in the face of strong global competition.

Ports do not only accommodate freight and passengers. They are also quite often the site of energy nodes, clusters of maritime transport logistics and also a hub for tourism activities. The European Commission (EC) has published a Staff Working Document (SWD (2016) 326) on the implementation of the EU Maritime Strategy 2009-2018. The Working Document analyses the current situation of the sector, the implementation of the EU Maritime Transport Strategy and the necessary steps for adapting EU legislation. Concerning maritime safety, the EC will evaluate the EU legislation, especially in the vessel traffic, monitoring, Port State Control (PSC) or flag state responsibility.

FIG. 1 MARITIME TRANSPORT IN THE EUROPEAN UNION. SOURCE: ELABORATED FROM EUROSTAT DATABASE MARITIME TRANSPORT 2017

FIG 2: THE *AMOCO CADIZ* SPILL IN MARCH 1978. SOURCE: NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

Port State Control and the Paris MoU

According to the provisions of the United Nations Convention on the Law of the Sea (UNCLOS) 1982, Art.91: "Every state shall fix the conditions for the grant of its nationality to ships, for the registration of ships in its territory, and for the right to fly its flag". That is, there is a direct relationship between the ship and its flag state.

Art.94. of UNCLOS specifies the control that should be exercised by the flag state over the ship: "Every state shall effectively exercise its jurisdiction and control in administrative, technical, and social matters over ships flying its flag." In short, every flag state must carry out control over the ship to which it has granted its nationality with regard to construction, navigability, manning, onboard working conditions, prevention of pollution and maritime safety.

With the study of serious incidents caused by ships, it has been demonstrated that flag states do not perform the proper technical control over vessels included in their registries. This absence of control reduces shipowner costs regarding the use of the ship. In 2002, the Committee of Maritime Transport of the Organisation for Economic Co-operation and Development (OECD) defined a "sub-standard ship" as one that "fails to meet the basic standards of seaworthiness and as a consequence is a threat to both human life and/or the environment" (Lechuga, 2009). The principles of PSC have their origins in the need to ensure that ships from other flag states can go to sea without endangering maritime safety, human life or the marine environment.

In July 1982, the Paris Memorandum of Understanding (Paris MoU) was initially signed by 14 European countries. Its origins go back to the social, political and economic outcry resulting from the *Amoco Cádiz* disaster of 1978, when an oil tanker ran aground off the French coast, spilling some 230,000tonnes of crude oil, causing one of the greatest marine environmental disasters. At the time of the incident, the maritime authorities of several western European countries were developing the so-called 'Memorandum of the Hague', which was essentially linked to the conditions of life and work on ships, following the requirements established by the 1947 Convention of the International Labour Organization (ILO). However, given the gravity of *Amoco Cádiz*, it was necessary to establish a more exhaustive and effective memorandum, covering aspects such as the safety of human life at sea, the prevention of marine pollution, and ensuring adequate living and working conditions on ships.

In support of these objectives, and in addition to the systems and procedures operating in each country, the EU established the Port State Control Directive. The objective of this legislation is to ensure compliance with international standards by ships in EU ports and, therefore, to ensure that ships sailing in EU waters are built and maintained in accordance with current maritime legislation. In this context, the European Maritime Safety Agency (EMSA) has technical responsibility for overseeing the PSC at EU level. This implies evaluating the PSC inspection system established by individual EU members, conducting comprehensive analyses of the statistics related to the ships that call at EU ports, and analyses of the data on individual ship inspections.

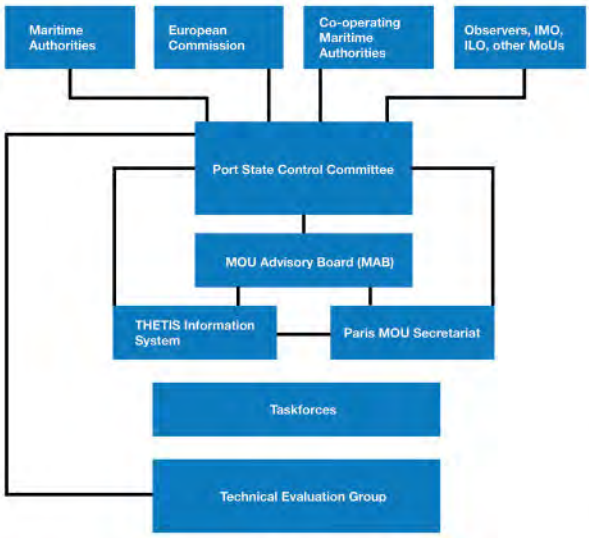


FIG. 3. STRUCTURE OF THE PARIS MOU. SOURCE: PARIS MOU

Risk assessment studies, combined with statistical research, provide results that are used to develop objectives and procedures for the continuous improvement of PSC performance in the EU. The primary objective of the Paris MoU is safety and the fight against pollution in European maritime transport, with EMSA coordinating the actions of PSC in all EU member countries and non-EU signatories to the Paris MoU (e.g. the United Kingdom). This form of control can have a deterrent effect on operators of sub-standard ships when they are directed to ports where this form of control is applied. A standardised inspection system consists of different agreements or memoranda, depending on the territorial scope of application (such as the Tokyo MoU and Viña del Mar) but all of them have in common that inspections are focused on checking compliance with the international standards.

The 'Paris Memorandum of Understanding on Port State Control' is the official document by which 27 maritime authorities currently agree on the implementation of a standardised PSC system. The document contains text and provisions, including annexes, which the authorities must agree on:

a) The commitments are to maintain international conventions relevant to the agreement.
b) The operational procedures for inspection and investigation.
c) The exchange of information between the authorities.
d) The structure of the organisation and the amendment procedures.

Currently, the following countries' authorities have signed the agreement: Belgium, Bulgaria, Canada, Croatia, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Romania, Russia, Slovenia, Spain, Sweden and United Kingdom of Great Britain and Ireland (North).

Authorised PSC inspectors must meet a series of minimum requirements in terms of academic qualifications, experience in the sector and training, determined by the corresponding Maritime Administration of each state and taking into account the internationally approved instruments that are relevant for PSC. Fig 3 shows the organisational structure of the Paris MOU, highlighting the executive portion of the Paris MoU formed by the PSC Committee. This committee is comprised of the 27 maritime authorities that signed the memorandum, the EC, Maritime Authorities of other Memorandum and representatives of IMO and ILO. IMO is the main driver of the PSC system. The databases related to different PSC inspections are interconnected to develop a more efficient system of supervision of the maritime transport sector. The Paris MoU databases are interconnected with the Caribbean MoU, ABUJA MoU, Tokyo MoU, and Black Sea MoU.

Evolution of the Paris MOU

PSC in the EU was substantially modified in 2009 by Directive 2009/16/EC of the European Parliament and of the Council of 23 April, on the control of ships by the PSC, which repealed the Directive 95/21 / EC. Directive 2009/16/EC entered into force on 1 January 2011, which introduced the following:

- The establishment of common criteria for control of ships by PSC and standardisation of inspection and immobilisation procedures, taking advantage of the expertise and experience acquired within the framework of the Paris MoU.
- The implementation of a PSC system based on inspections of all ships in the region of the Paris MoU with a frequency according to their risk profile, subjecting the ships that represent greater risk to more rigorous inspections.
- The creation a professional profile of PSC inspectors and the promotion of training.
- The creation of an inspections database that contains all the relevant information to assign a risk profile to each ship and its frequency of inspection. This database is currently known as THETIS (The Hybrid Electronic Targeting and Information System). All ships in the THETIS system are categorised as low, standard or high risk based on the ship's historical and technical parameters.
- Each member state of the Paris MoU has been assigned an annual quota of inspections of ships. The inspection quota for each member state is based on the ratio between the number of ships calling at ports of the member state and the total number of ships calling at ports of each of the states of the EU and Paris MoU regions.

The flag state has responsibility for ensuring a ship complies with international conventions, those that do not impose effective compliance pose a serious risk to the safety of their ships, the life of the crews and the marine environment. A ship that repeatedly fails to comply can, in the event of accident, cause a catastrophe in the marine ecosystem, significant economic loss and, in the worst case scenario, the death of crew members.

The objective of our research was to demonstrate the impact of the PSC on safety and the fight against

pollution in European maritime transport. To this end, the main international conventions of the IMO are analysed, where the operational supervision of PSC is established. In order to demonstrate a direct relationship between the PSC and maritime transport safety, it will analyse data published by the Paris MoU since 2009. This will show how PSC has become a fundamental tool to avoid maritime accidents involving loss of ships and human lives or serious environment pollution.

Theoretical and legislative frameworks

There have been numerous scientific studies of PSC. Alcázar and Piniella (2002) analysed the prevention of maritime accidents through the PSC system. Özcayir's 2004 book 'Port State Control' provides a detailed analysis about the PSC legal framework, regional agreements and the EU directive. Knapp and Frances (2007) were pioneers in introducing the econometrics analysis for the study of the PSC. Knapp and Van de Velden (2009) proposes that it is necessary to review the frequency of inspection according to the ship risk profiles, a recommendation implemented by the Paris MoU with Directive 2009/16 / EC, which took effect from 2011. Chatzirigopoulou (2010) provides the legal basis for the PSC. Ravira and Piniella (2016) evaluate the impact of the professional profile of PSC inspectors on the inspections carried out, focusing on the Spanish Maritime Administración.

IMO (2000 and 2001) through Resolution A.787(19), and amended by Resolution A.882(21) and the Port State Control model course 3.09, have established standardised procedures for PSC activities. Additionally, the Paris MoU, when establishing the PSC, defines specific procedures for all PSC officers. The Sub-Committee on Implementation of IMO Instruments (2014) in Agenda item 5 established a working group on harmonisation and improvement of PSC.

Legislation that allows state control over foreign ships in its ports is imposed by international maritime law; UNCLOS Articles 194, 197, 211 and 218 specify: "Coastal States may, in the exercise of its sovereignty over the territorial sea, adopt laws and regulations to prevent, reduce and control pollution of the marine environment by foreign vessels, including vessels exercising the right of innocent passage". Below is a summary of the main international conventions of IMO and ILO that cover the PSC actions:

- International Convention for the Safety of Life at Sea, SOLAS 74/88, Chapter I, Rule 19 - Chapter IX, Rule 6.2 - Chapter XI-1, Rule 4.
- International Convention for the Prevention of Pollution from Ships, MARPOL 73/78/97, Annex I, Rule 11- Annex II,Rule 16-Annex III, Rule 15 - Annex IV, Rule-14- Annex V, Rule 9- Annex VI, Rule 10.
- International Convention on Load Line - Agreement 1966/88, Article 21.
- International Convention on Tonnage Measurement of Ship 1969, Article 12.
- International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, STCW 2010, Article X.
- International Convention for the Control and Management of Ballast Water and Sediments from ships 2004, Article 9.
- Maritime Labour Convention 2006, Title 5, Rule 5.2.

The above regulations can be summarised as follows:

a) Any foreign vessel will be subject to the inspection of officials duly authorised by such governments in the ports of the other contracting governments.
b) The purpose of these inspections will be to verify the onboard existence of valid certificates.
c) Certificates will be accepted unless there are clear indications to suspect that the state of the vessel or its equipment does not correspond to the details of the certificates. In this case, the official performing the inspection will take the necessary measures to ensure that the ship does not leave port until it can go to sea without danger to human life, maritime safety and pollution of the marine environment.
d) When the inspection of the duly authorised official results in an intervention on the ship, the flag state shall be informed immediately.
e) A vessel shall not be unduly detained or delayed. If so, they will be entitled to due compensation.

Analysis

Based on the statistical analysis of the data published by the Paris MoU from 2009-2018, the impact of the PSC on European maritime transport was analysed (Paris MoU Annual report, 2009-2018). For the period represented in Fig 4, an average of 15,007 individual ships were inspected per year. The year 2013 had the fewest individual ship inspections, 14,108, and 2014 had the most individual ships inspections, 15,386.

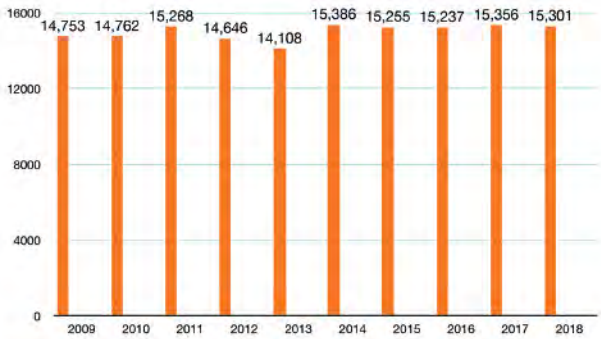


FIG. 4. NUMBER OF INDIVIDUAL SHIPS INSPECTED IN THE PARIS MOU 2009-2018

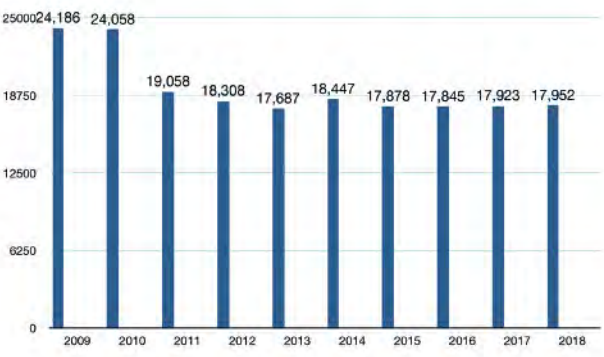


FIG. 5. NUMBER OF INSPECTIONS IN THE PARIS MOU IN 2009-2018

If we analyse the data for the total number of inspections conducted in Fig 5, there are two clearly differentiated periods. The first encompasses 2009 and 2010, with an average of 24,122 inspections, while the second period covers 2011 to 2018, with an average of 18,137 inspections. Within the second period, there is a reduction of 24.82%, in the average number of inspections performed.

Fig 6 presents the number of detained ships each year. In 2009, there were 1,059 detentions, decreasing by 53.44% to 566 in 2018. If we analyse detentions for 2009-2018, 705 ships were detained, but if we exclude 2009, i.e., during the period 2010-2018, an average of 666 ships were detained. The highest number of detentions occurred in 2009, even though the number of individual ship inspections was only 14,753, less than the annual average by 1.70%.

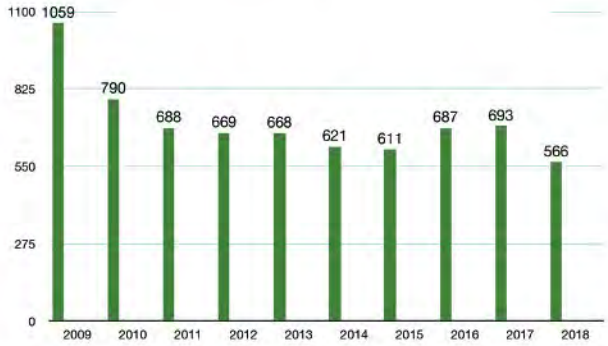


FIG. 6. NUMBER OF VESSELS DETAINED IN PARIS MOU 2009-2018

Fig 7 shows the number of ship deficiencies under the Paris MoU during 2009-2018. The number of deficiencies significantly reduced from 71,911 in 2009 to 40,368 in 2018, which is by 43.87%. The largest decrease was observed from 2010 to 2011.

As Fig 8 shows, there are three periods distinguished by significant changes in the number of deficiencies. The average of deficiencies in 2009-2010 was 68,304, in the period 2011-2014 this was 48,824, and the third period 2015-2018 was 41,361. There is a progressive decrease in the number of deficiencies found in ships.

Fig 9 displays the ratio of detentions based on the percentage of individual ships inspected. If we compare the absolute data between the year 2009 (7.17%) and 2018 (3.69%), there is a decrease of 48.53% in

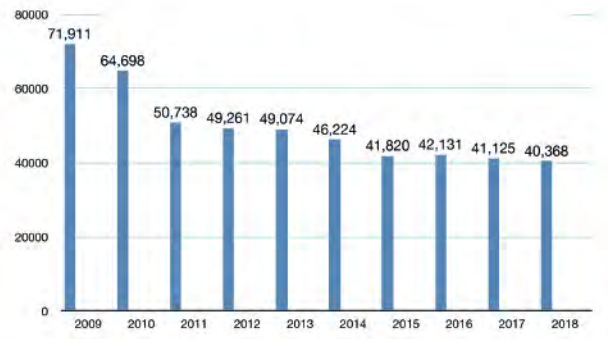


FIG. 7. NUMBER OF DEFICIENCIES IN THE PARIS MOU SHIPS 2009-2018

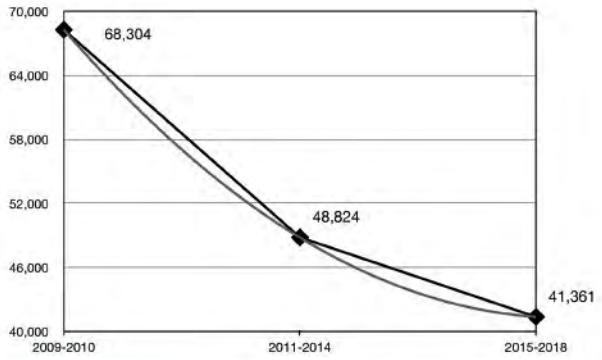


FIG. 8. AVERAGE DEFICIENCIES IN TERMS OF THE INSPECTION PERIOD

the ratio of individual ships detained. There is also a clear decrease in the detention ratio in 2018 to 3.69%, compared to 4.50% in 2017 and 2016.

Conclusions

PSC inspections in European maritime transport have become the main strategy for eliminating ships and shipowners who repeatedly fail to comply with international regulations. These vessels put maritime safety, human life and the marine environment at risk. The Paris MoU, from its origin in 1982 to the present, has notably increased the control of European maritime transport. The new inspection regime that went into effect on 1 January 2011 led to a significant change in the impact of PSC on the safety of and pollution by maritime traffic.

One of the main contributions has been to establish the THETIS database system, from which a risk profile of each ship is developed. This in turn determines the frequency and type of inspection to which it will be subjected. This effort has resulted in the annual inspection of an average of 15,000 ships, of which an average of more than 600 are detained due to serious deficiencies found during inspections. The training of PSC officers has been intensified. The European Maritime Safety Agency has established an online system and classroom training that seeks to harmonise the inspection procedures in Paris MoU states, the detention criteria and the deficiencies that can be causes for detention. Collaboration and exchange of information with other regional PSC agreements has been very beneficial for monitoring sub-standard ships and trying to eliminate them from international maritime transport.

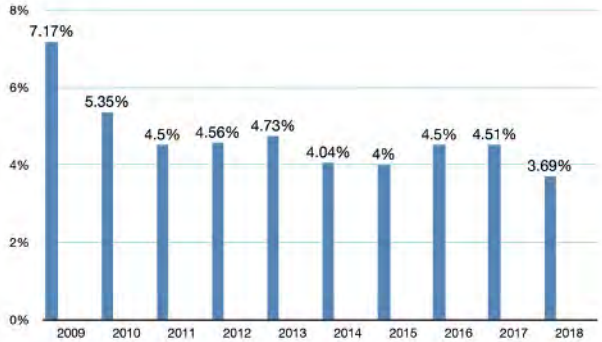


FIG. 9. RATIO DETAINED PERCENTAGE OF INDIVIDUAL VESSELS INSPECTED BY PARIS MOU IN 2009-2018

As the main strategy for the control of European maritime transport, PSC has managed to significantly increase safety and reduce pollution of the marine environment, but efforts should be intensified to prevent another maritime tragedy. For this, the Paris MoU should intensify the exchange of information with all agents involved in global maritime traffic: other regional PSC agreements, classification societies, shipowner associations, shipping companies, maritime insurance, flag states, etc. The objective should be to eliminate ships from maritime traffic that violate international conventions; such ships elevate the risk to maritime safety, human life and the marine environment.

PSC measures have evolved to avoid marine casualties such as the ships *Erika* (1999) and *Prestige* (2002); the latter incident spilled some 77,000tonnes of HFO and polluted thousands of kilometres of the Spanish, French and Portuguese coasts. A responsible society cannot allow the discharge of polluting products to the marine environment caused by sub-standard ships that could wipe out a complete ecosystem and expose crews to serious risk.

The PSC authorities contributes in an important way to ensure that marine transport in the EU is safe and less polluting with the marine environment. Since 2009, the EC has assisted the member states in the implementation of a new risk-based approach to inspections. Persistently substandard vessels can be banned from European waters. EMSA provides all member states (as well as Norway, Russia and Canada as members of the Paris Memorandum of Understanding on Port State Control) with technical support on the new inspection regime and operates the system for targeting vessels and reporting of results (THETIS database).

The immediate future presents great challenges for the PSC. One of the most important challenges will be autonomous ships. These ships and systems are generating new challenges in terms of safety navigation, marine equipment, human element and risk management. Therefore, the training of PSC officers must be a priority for the EU Maritime Authorities, Paris MoU and EMSA. ■

Acknowledgements
We offer our regards to the Paris Memorandum for the data provided for this research.

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FIG. 10: A VICTIM OF THE *PRESTIGE* OIL SPILL IN 2002. SOURCE: CREATIVE COMMONS

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LETTERS TO THE EDITOR

MIXED OPINIONS FOR THE 50TH ANNIVERSARY REDESIGN

The recent edition of *The Naval Architect* commemorating the 50th anniversary of the journal's publication has brought back memories from when I became a Junior Member whilst still studying at Birkenhead Technical College in the late 60s. At that time most of the contributions in the "Transactions" went over my head and in the main it was the practical rather than theoretical contributions typical of which would be written by Marshall Meek and colleagues on the 'Encounter Bay' and 'Liverpool Bay' series of container ships. Useful to me because at that time I was employed by another Liverpool-based shipping company looking into the prospect of containerisation.

I retired as a Senior Principal Surveyor to a Classification Society 11 years ago and initially gave the journal a cursory glance unless there was something that in particular caught my attention and would most likely be associated with my previous career.

I can now write to thank you for the subtle changes to the journal that have, to me at least, made it more interesting, readable and invariably well thumbed before the next edition appears. That the journal has increasingly covered a wider application of disciplines within the marine industry makes for a more comprehensive overview and a small insight into the changing technology.

During my working life my career took me to many different countries and I realised very quickly the importance of communication. I detect within the journal a progressive subtle change in the use of the English language from formal to less formal without losing the importance of the article. Keep it up.

Yours sincerely,
Roger Daniel, FRINA ■

The primary function of a typeface is to be legible – any artistic or other considerations are secondary. In the April issue, form does not follow function as the typeface is very difficult to read. Ironically, all the adverts are quite easy to read and even the small reproduction of the editorial for April 1971 is more readable than the current issue.

I hope the typeface will be changed back in future issues as I'm not sure I can be bothered to struggle through the present editorial content.

Regards
J. W. Holness ■

Much as I appreciate the attempt to freshen-up the appearance of *TNA*, I find the online 'Reader' version almost unreadable. I need to apply two hits of the magnify button to get the font to a size that I can easily read, but then find the navigation around the magnified page very clunky.

The new font style or design is, in my opinion, an improvement however the font colour results in insufficient contrast against the white background page colour. On zones of pages where the font is either a white or a dark colour on a dark background the lack of contrast is even worse. In general all the pages of the reader version lack sufficient clarity.

I hope the graphic artists and technicians may be permitted some opportunity improve the appearance of the digital versions of *TNA*.

Kind Regards,
Guy Anderson,
Canberra, Australia ■

Having received my copy of the magazine mentioned above, I want to inform you about my disappointment. The lettering is in some sort of light greyish and moreover too small to read anyway. Alas, into the waste basket!

Please improve the readability of your magazine,

Yours
Cornelius Schneiders, FRINA
Ommen, the Netherlands ■

Editor's comment: Thank you to those who expressed their opinions, positive and negative, about the title's new look and other aspects of the 50th anniversary edition. As custodians of a publication with half a century of history, there is always a challenge in remaining faithful to its heritage while reflecting new trends and ideas, and that extends to the look of the magazine. The redesign was a result of numerous meetings between RINA staff and certainly wasn't a process that was undertaken lightly.

However, as with any process there is an element of trial and error. We recognise that the typeface may have proven difficult to read for some. For that reason I requested that we enlarge and darken the text used for the 'body' copy with this issue and hope this will remedy some of the criticisms. We will of course continue to keep the matter in review and may make further subtle adjustments in the coming months.

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AN OPEN LETTER FROM THE IWSA

We, the undersigned,

Call on all maritime industry decision-makers and the entire shipping community to fully assess and utilise all available power solutions that deliver the necessary deep, swift cuts in carbon emissions over the next decade commensurate with responding to the climate emergency. To that end, readily available and proven wind propulsion solutions must be integrated at the very heart of decarbonisation deliberations.

Direct wind propulsion provides an abundant, free energy, immediately and uniquely suited to and accessible to shipping worldwide without the need for costly land-based infrastructure or logistics investment. Wind technology helps de-risk shipping from its dependency on bunker fuels. Emerging alternative fuels come with multiple challenges – cost, availability, density and quality and wind propulsion decouples shipping somewhat from these huge uncertainties around whatever 'flavour' eco-fuel is adopted.

Whatever size or type of commercial vessel, wind-assist or primary wind propulsion systems quickly provide credible, practical, robust, scalable and economically viable solutions – a dozen large oceangoing vessels will be in operation by the end of Q1, 2021, along with 20+ small sail cargo and small cruise vessels.

The potential exists for 20-30% of the global fleet's energy requirement to be delivered by wind systems. By adopting wind solutions as part of a hybrid propulsion approach, vessel owners and operators can substantially deliver on the initial level emission savings targets for 2030, thus providing a critical component and step for achieving the 2050 target. A UK Government-commissioned study forecasts up to 45% penetration of wind technologies into the global fleet by 2050. A key EU-commissioned report on wind estimates up to 10,700 installations are possible by 2030, including roughly 50% of bulkers and 67% of tankers alone.

Wind propulsion reduces demand, cost and power storage requirements for the next generation of alternative fuels, which further helps to accelerate and enable the take-up and cost-efficiency of these alternative fuels.

Therefore, we call on all shipping industry decision-makers to:

1. Establish a Multi-Stakeholder International Working Group to evaluate and quantify wind propulsion's potential contribution to decarbonise the global fleet in the face of the climate emergency. Promote the potential from a hybrid approach to decarbonisation with wind propulsion fully integrated together with operational and vessel optimisation measures along with eco-fuels.
2. Launch a Comprehensive Strategic Review of shipping industry decarbonisation efforts in the context of the climate emergency. Covering all criteria, designations and databases/resources being used, this review would incorporate wind propulsion into all calculations and include a full life cycle analysis of all alternative propulsion systems and fuels so that the industry can fully appreciate the merits of each proposed system. The review should quantify all externalities including infrastructure development and production costs of all alternative propulsion systems and fuels along with their direct and indirect climate impacts.
3. Ensure a 'level playing field' is created and maintained for all power systems, removal of market and non-market barriers as well as fair and balanced allocation of R&D finances and resources in the future.
4. Do more and go beyond the current narrow fuel-centric approach by adopting a fully integrated alternative propulsion approach to decarbonisation pathways and policy.

Doing so will create a proportionate, measured strategy that is absolutely essential to achieving the industry emissions targets. We believe that wind propulsion systems must be fully integrated within this strategy to help achieve decarbonisation as quickly as possible and that this will be broadly welcomed by the shipping industry. ■

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IMO International forum
Location TBC

SEPTEMBER 21-24, 2021
NEVA
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International Conference
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NOVEMBER 24-26, 2021
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IMO International forum
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